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Joe Merrell

Public Release Review

(Statement A)

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41 items enclosed



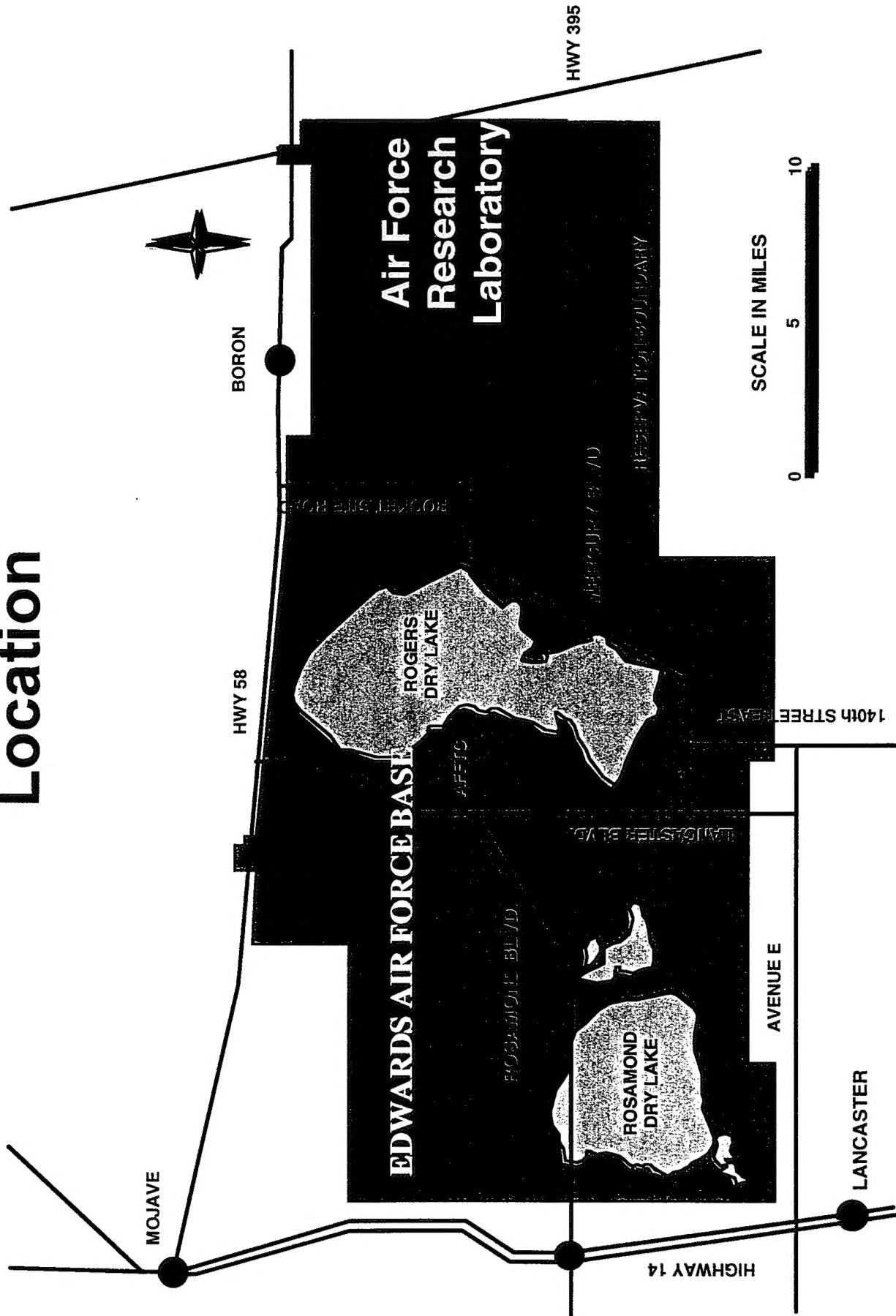
Air Force Research Laboratory Propulsion Directorate Test Facilities

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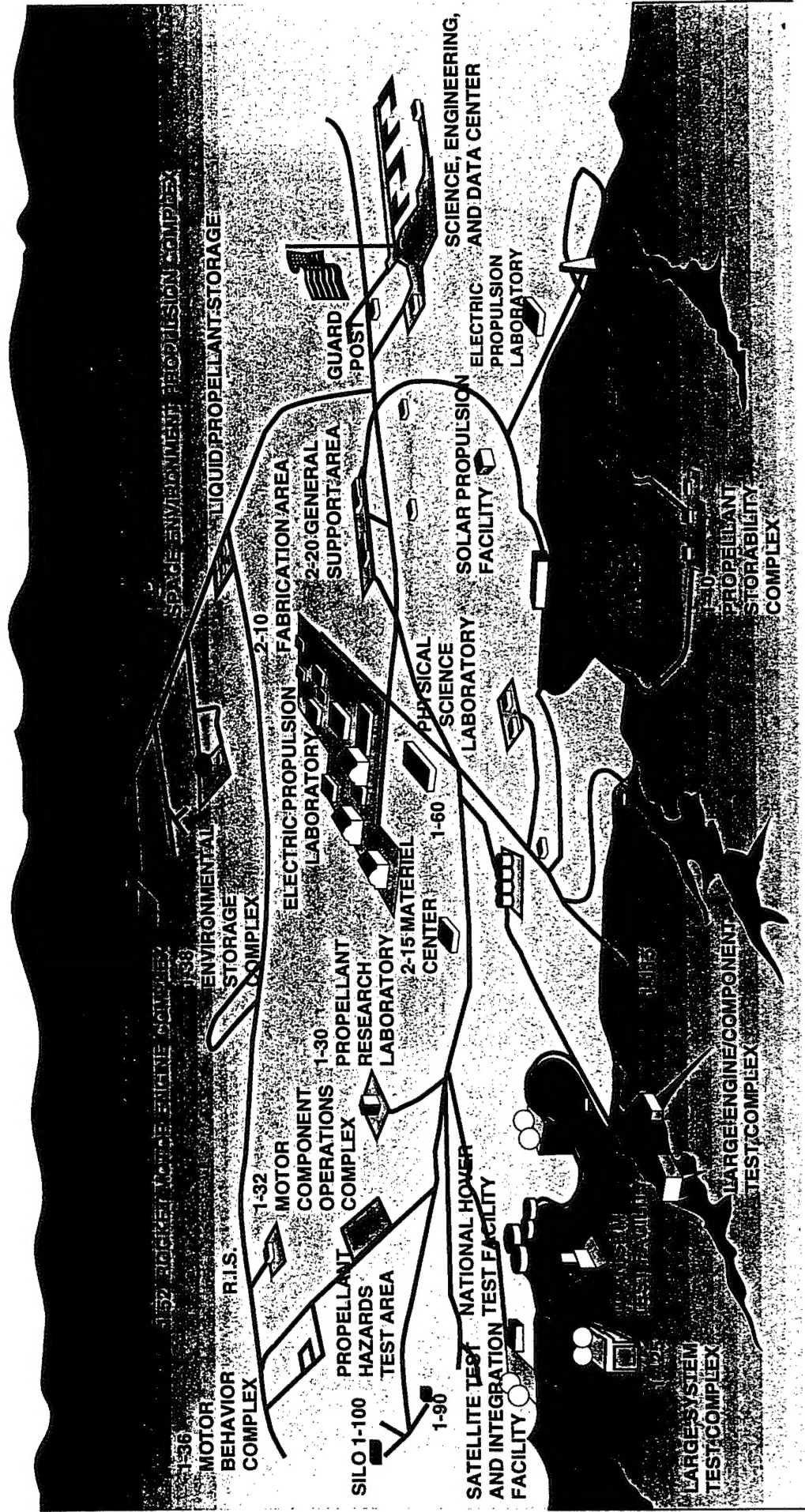
Air Force Research Laboratory Location

D2318A 001





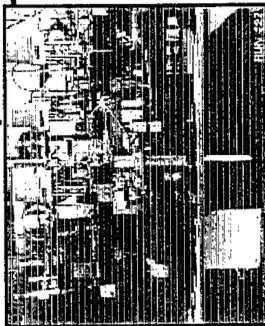
Air Force Research Laboratory Propulsion Directorate Facilities





Propulsion Directorate

Satellite Propulsion



- To 5,000lb Thrust
- Horizontal Single Axis
- LOX/GOX/Hydrazine/NTO

Small Solid Components



- MM I / MM III
- MX
- SICBM
- KKV
- To 36,000lb Thrust
- Horizontal Single Axis (Spin Capable)
- Temp Conditioned 30° to 120°F

Large Solid Components



- SERGEANT
- STARBIRD
- VIPER
- F-16 LIVE FIRE
- MX
- BULL PUP
- To 300,000lb Thrust
- Horizontal and Vertical Multi Axis
- Temp Conditioned 30° to 120°F
- Spin Capable

Experimental Systems

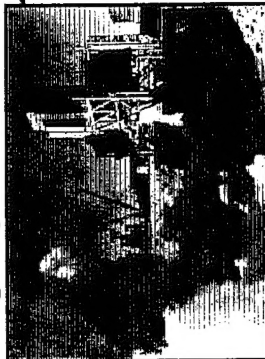


- HEDM
- ATLAS
- SATURN V

- To 1,500,000lb Thrust
- Horizontal or Vertical Single Axis
- Dual Position (Expandable to Quad and 6,000,000lb Thrust)

**TO 10,000,000 LB THRUST
FIXED OR SPIN
HORIZONTAL OR VERTICAL
ORIENTATION
ENVIRONMENTAL CONDITIONING
HIGH HAZARD**

Large Systems Complex



- SATURN V
- TITAN IVD
- TITAN 34D

- To 8,000,000lb Thrust
- Vertical Multi Axis
- Temp Conditioned 25° to 100°F
- Humidity Conditioned at 40%

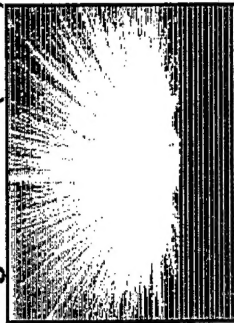
High Thrust (Solid and Liquid)



- TITAN IVD
- SUPER HIPPO
- R.R. TANK CAR

- To 10,000,000lb Thrust
- Horizontal or Vertical Multi Axis
- LOX/Hydrogen/Hydrazine/NTO

High Hazard (Solid)



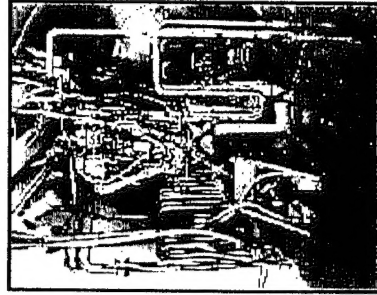
- 2.75 RAP
- MINI RPV
- MX
- F-16 HYDRAZINE TANK
- SHUTTLE STORAGE VESSELS

- To 4,000,000lb Thrust
- Horizontal Single Axis
- Temp Conditioned 30° to 120°F



Propulsion Directorate

Satellite Propulsion



- MILSTAR

- 6 Hours at 125,000 Feet
- Horizontal Single Axis to 1,000lb Thrust
- LOX/GOX/Hydrogen/Hydrazine/NTO

Space Experiments (SPEF)



- CENTAUR
- STM/TTM
- MSTI
- GOSSAMER TORUS

- Continuous at 650,000 Feet (Sim)
- Temp Conditioned -300 to +400
- IR/UV Solar Simulation

TO 650,000 FEET SIMULATION
TO 60,000 LB THRUST (FIXED OR SPIN)
HORIZONTAL OR VERTICAL
ORIENTATION

ENVIRONMENTAL CONDITIONING

Electric Propulsion



- ESEX
- ELITE

- Continuous at 650,000 Feet (Sim)
- Temp Conditioned -300 to +400
- IR/UV Solar Simulation

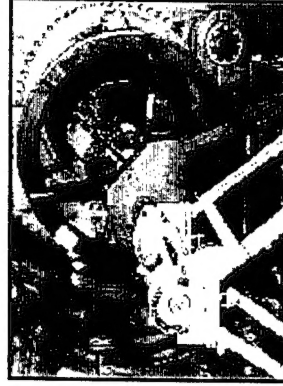
Space Propulsion (Liquid)



- AGENA
- JPL STORABLE PROPULSION
- STAR TECH
- XLR-132
- SKYBELT

- 20 Minutes at 110,000 Feet (Sim)
- Vertical Single Axis to 50,000lb Thrust
- LOX/Hydrazine/NTO

Space Propulsion (Solid)



- TRIDENT C4
- SICBM
- HAST
- PEACEKEEPER
- AIR AVG
- DELTA V

- 20 Min at 110,000 Feet (Sim)
- Horizontal Multi Axis to 60,000lb Thrust
- Fixed or Spin Capable

Space Propulsion (Solid)



- KHIT
- AIS
- VIPER
- ASAS

- To 110,000 Feet (Sim)
- Horizontal Multi Axis to 50,000lb Thrust
- Contained Exhaust



Propulsion Directorate

D2318A 05

Flow Laboratory



- To 3,500 PSI and 16" Pipe
- 3 Isolated Water Systems
- To 32 GPM
- Flow and Mass Mixture Ratio
- Particle Sizing

Plume Studies

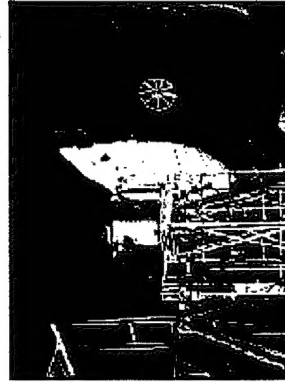


- SIDEWINDER
- SICBM
- SERGEANT
- VIPER

- Near IR/Visible/UV
- Horizontal or Vertical Orientation
- Temperature Mapping
- Particle Collection

VEHICLE FLIGHT/HOVER TESTING REDUCED SMOKE PROPULSION STUDIES SOLAR THRUSTER EXPERIMENTS SATELLITE g LOAD STUDIES TETHERED LAUNCH CAPABILITY

Solar Laboratory



- To 5,000 F
- 24 X 32 Autotrack Heliostat
- 10,000 to 1 Concentrator
- Continuous at 0.1 PSIA

- SOLAR THRUSTER

Hover Site



- Enclosed Flight Bay (70 X 40 X 30)
- Temp Conditioned -20 to +130 F
- Static Test Stand (Pre-Flight)
- Cleanroom Integration Capability
- Optical Target 800 Meter From Bay

- KHIT
- KKV
- LEAP
- ASAT
- SCIT

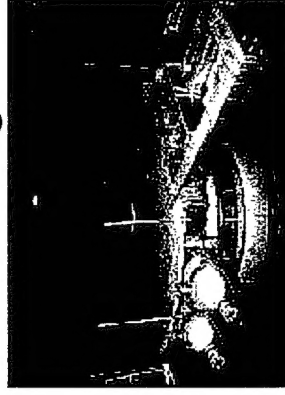
Silo



- MM

- Dual Silos
- 26 Feet Dia X 86 Feet Deep

Centrifuge



- 2.75 RAP

- To 48 g at 21 Feet
- To 82 RPM
- To 30,000lb Test Article
- Temp Conditioned -300 to 500 F
- Humidity Conditioned to 95%



Satellite Engine Complex

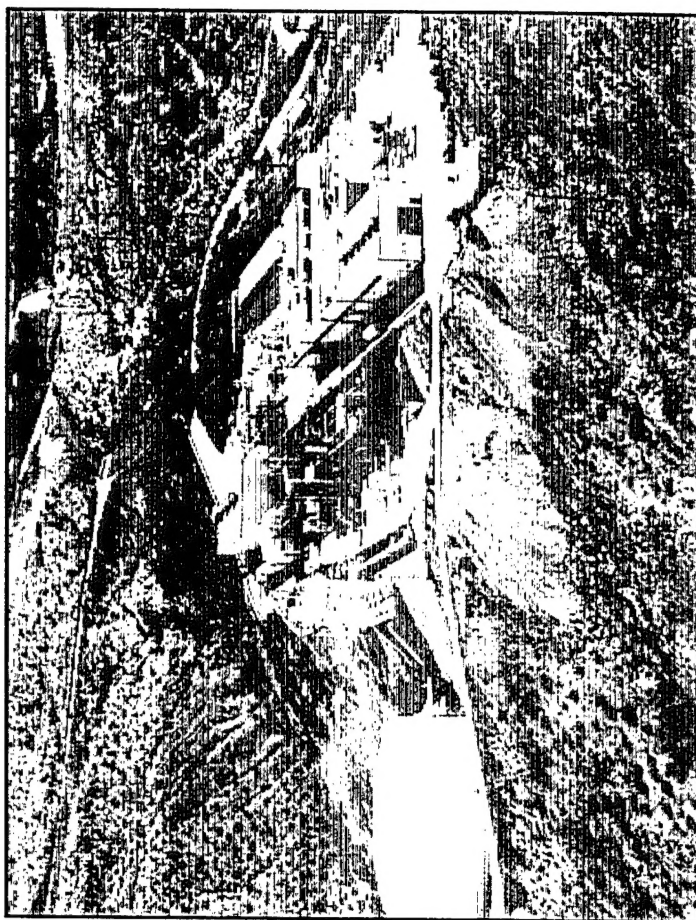
Area 1-14

GENERAL AREA CAPABILITIES:

- Propane-fired steam/vacuum system, up to 6 hours run time, 125 Kft simulated altitude
- Mechanical pump/diffusion system can be connected to C, D, E Chambers and Pump up to 700 Kft Simulated Altitude
- Two Data Acquisition Systems:
- 6000 psi GN2, Ample Water, LN2, LOX, GH2, Propane Tankage

CELL CAPABILITIES:

- Each Chamber / Stand Rated to 425 lb of 1.1 TNT Equivalent Liquid Propellant
- 4 Vacuum Chambers for Engine/Component Testing
 - A Cell - 1000 Lbf Thrust, 125 Kft Alt.
 - C Cell - 100 Lbf Thrust, 700 Kft Alt.
 - D Cell - No Thrust Stand, 260 Kft Alt.
 - E Cell - 300 Lbf Thrust, 260 Kft Alt.
- 2 Ambient Thrust Stands
 - B Cell - 15K Lbf Horizontal
 - D Cell - 5 Lbf HEDM Evaluation Stand



Testing History:

- Milstar Thruster
- Microcosm Low-Cost Engine
- Stoichiometric Gas Generator
- High Energy Density Materials Microthruster (HEDM)
- AeroAstro Low Cost Engine 1998
- X-34 Fastrack Injector 1997
- SSME Pre-Burner Injector 1997
- Atlas Vernier



Satellite Engine Complex

Area 1-14

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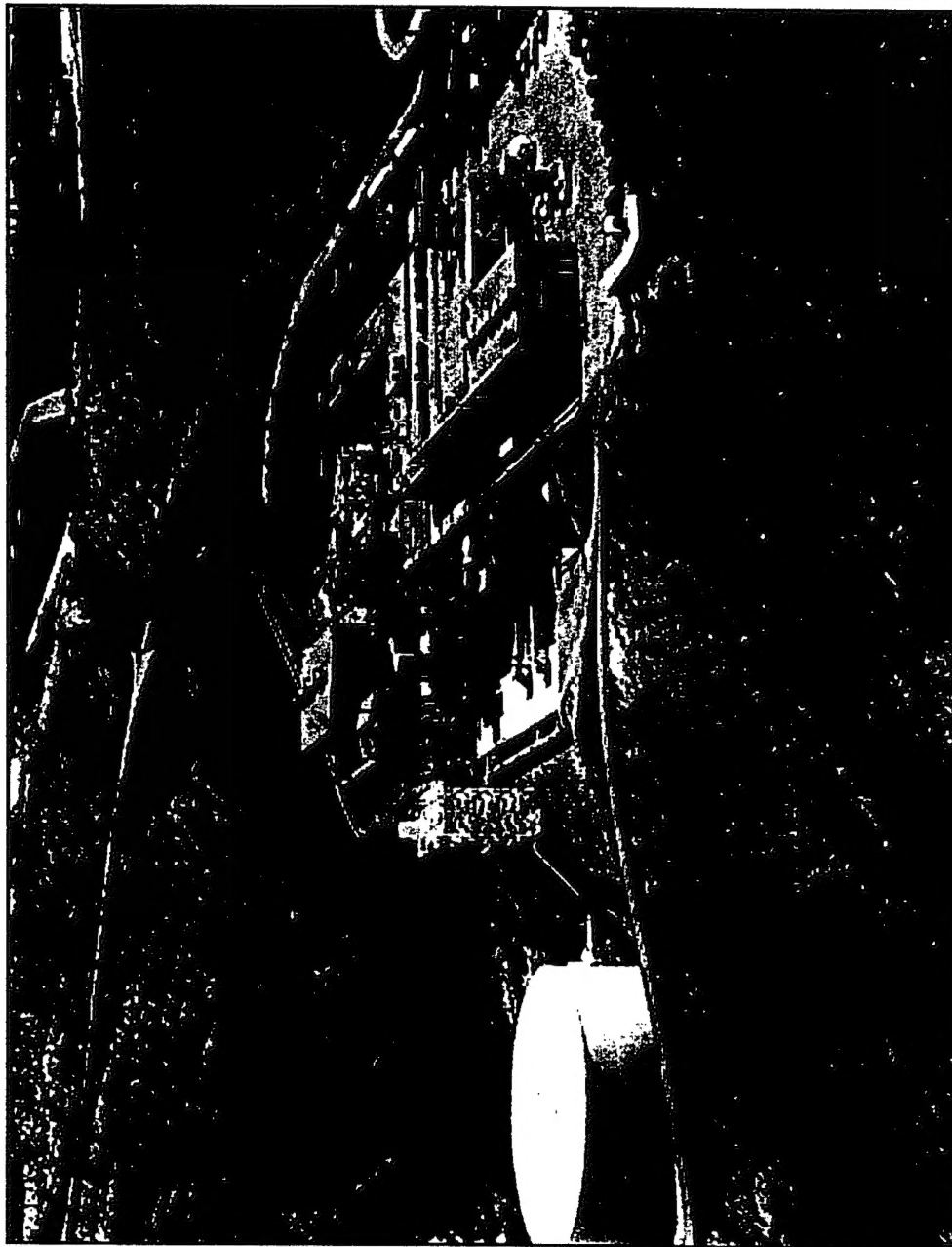
GENERAL AREA CAPABILITIES:

- Propane-fired steam/vacuum system, up to 6 hours run time, 125 Kft simulated altitude
- Mechanical pump/diffusion system can be connected to C, D, E Chambers and Pump up to 700 Kft Simulated Altitude
- Two Data Acquisition Systems
 - DATUM: 192 ch/50K Samples/Sec Throughput
 - CYBER: 64 Channels/100K Samples/Sec Throughput
- 6000 psi GN2, Ample Water, LN2, LOX, GH2, Propane Tankage
- Solar Laboratory
- 0 to 48 G Centrifuge
- Flow Laboratory

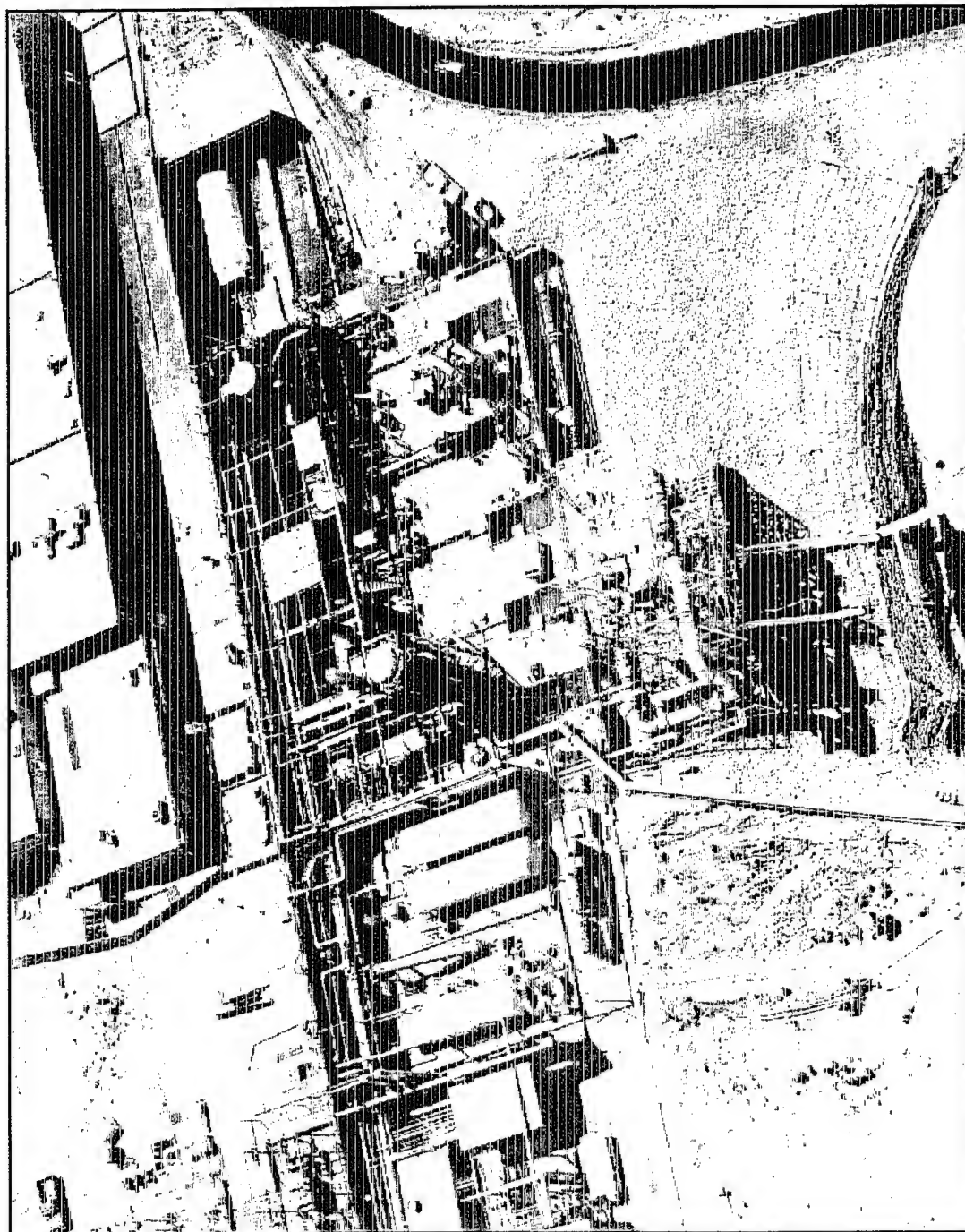
CELL CAPABILITIES:

- Each Cell Rated to 425 lb of 1.1 TNT Equivalent Liquid Propellant
- 4 Vacuum Chambers for Engine/Component Testing
 - A Cell - 1000 lbf Thrust, 8' x 31' 125 Kft Altitude, Stiochiometric Gas Generator
 - C Cell - 100 lbf Thrust, 7' x 12', 700 Kft Altitude
 - D Cell - No Thrust Stand in Chamber, 8' x 16', 260 Kft Altitude; MILSTAR Thruster Tests
 - E Cell - 300 lbf Thrust Vertical Chamber, 9' x 20', 260 Kft Altitude
- 2 Ambient Thrust Stands
 - B Cell - 15K lbf Thrust Stand, LOX/Hydrocarbon or LOX/LH2 ; Atlas Vernier, Microcosm LOX/RP-1
 - D Cell - High Energy Density Material 5 lbf Thrust Stand for Evaluation of Candidate High Density Energy Materials (HEDM) Propellants, LOX/Hydrocarbon

Area 1-14



Area 1-14

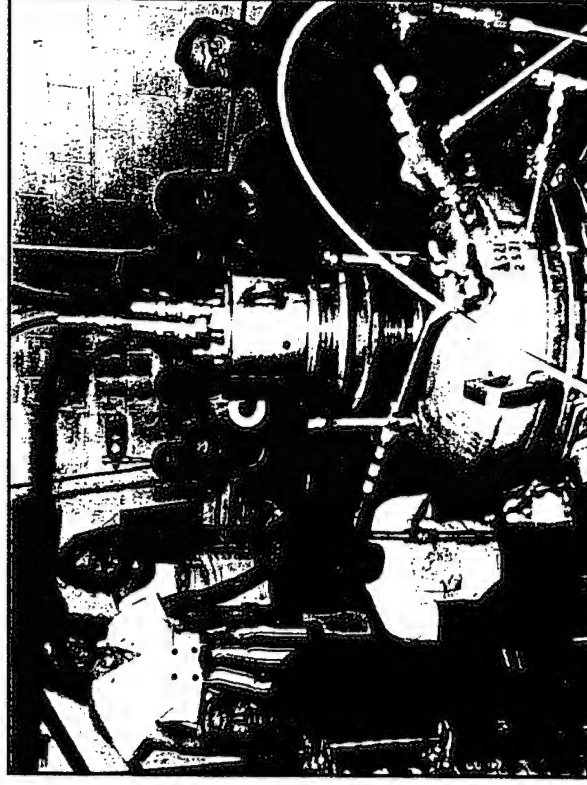




Flow Laboratory Area 1-14

CAPABILITIES:

- Multi-Element Injector to 1100 PSI and 2800 GPM
- Single Element Injector to 2000 PSI and 32 GPM
 - Modern Optical Design
 - Flow Visualization
 - Flexible Changeout
 - Mass Patternization
 - Simulation for Liquid
- Flow Checkout Facility
- Modern Optical Diagnostics
- Flow Visualization
- Flexible Change-Out Capability to Accommodate Different Kinds of Injectors
- Mass Patternization Via 27 Element Transversable Linear Array
- Simulation of Liquid Rocket Engine Manifold Cross Flow Effects
- Flow Checkout Facility to Verify Injector Design Prior to Hot Firing



PAST TESTING:

- XLR-132 Injector
- Microcosm Injector

FUTURE TESTING:

- Integrated Powerhead Pre-Burner Injector
- Rocketdyne Hybrid Injector
- Pac-Astro Injector
- Arcjet Platelet Injector
- X-34 Fastrack Injector 1997
- SSME Pre-Burner Injector 1997



Flow Laboratory, Area 1-14 High Pressure Injector Characterization Chamber Facility

GENERAL AREA CAPABILITIES:

- Unique facility Provides Full Scale, Single Element Windowed Cold Flow Injector Test Capability up to 2000 psi
- Injector Change-Out Capability to Test Most Injector Geometries
- Simulate Engine Injector Manifold Cross Flow Effects
- Drop Size and Velocity Measurement Capability

LAB CAPABILITIES:

- 2000 psi, 10 ft³ Chamber
- Liquid Flow Rates to 32 GPM
- Modern Optical Diagnostics
 - Malvern Line-Of-Sight Fraunhofer Diffraction Instrument
 - Aerometrics Phase Doppler Particle Analyzer
 - Coaxial Beam Particle Analyzer
 - Greefield Imaging Particle Analyzer
- Flow Visualization
- Spray Mass Distribution Measurements With 27 Element Traversable Array



High Pressure Injector Characterization Chamber Injector Design Methodology

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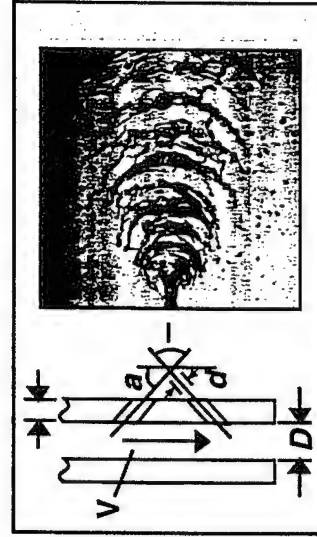
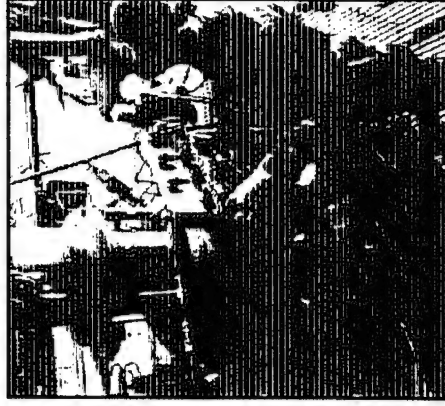
LASER DROPLET DIAGNOSTICS



GOALS

- Cost Effective Evaluation of Injector Designs
- Characterize the Effects of Injector Design Features on Performance and Stability

2000 psi PRESSURE VESSEL



TYPICAL IMPINGING INJECTOR SPRAY

ACCOMPLISHMENTS

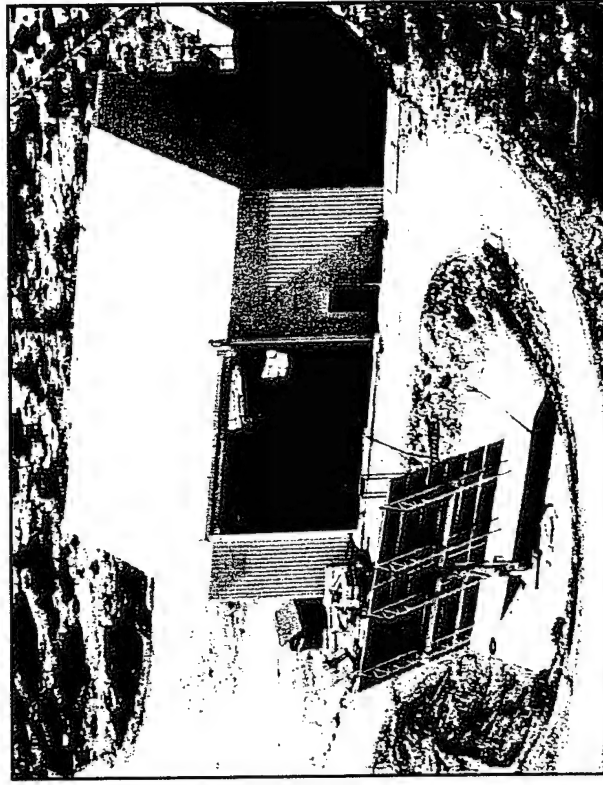
- In-House Testing 2000 PSI
- Atomization and Mixing Capabilities
- State of the Art Laser Measurements
- Manifold and Orifice Hydraulics



Solar Laboratory Area 1-14

CAPABILITIES:

- 10,000 : 1 Concentrator
- 32'x 2' Sun Tracking Heliostat
- 25 Kilowatt Concentrator, up to 5800 Degrees Fahrenheit
- 2.5 Gram/Sec Hydrogen or 5 Gram/Sec Helium Propellant Flow Rates
- 11lb Thruster Stand
- 30" x 30" Chamber
- 750 Kft Altitude
- 32 Channel, 10kHz, NEFF Data Acquisition System
- 6000 psi GN2



TESTING HISTORY:

- Black Body Cavity Receivers with Secondary Concentrators Attached
- Porous Disk Test Bed
- Solar Bi-Modal Cavity Receiver
- Video Flux Mapper, Water Filled Calorimeter
- Rhenium Tube Cavity Thruster
- Reticulated Vitreous Carbon Calorimeter



Rigidized Concentrators



1.2 meter Rigidized

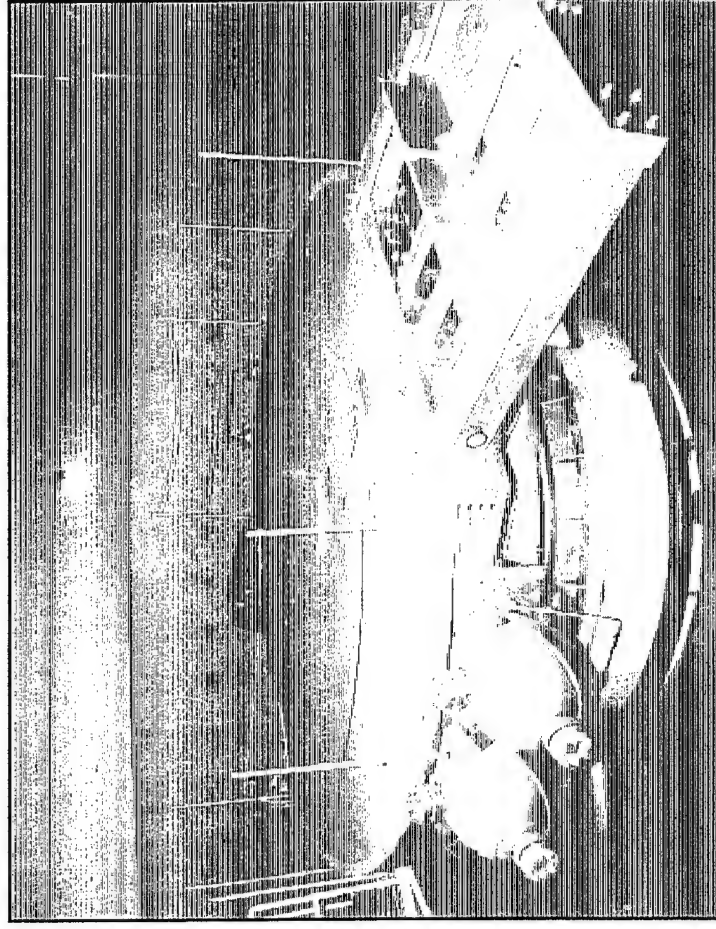


Centrifuge Facility Area 1-14

D2318A 015

CENTRIFUGE CAPABILITIES:

- Maximum G Range
 - 0 TO 30 G at 13 Foot Radius
 - 0 to 48 G at 21 Foot Radius
- 0 to 82 RPM
- Acceleration to 30 G in 5 Minutes
- 60,000 lb Total Capability
- Environmental Capability
 - (-300 to +500 Degree F)
 - 0 to 95 Percent Humidity



TESTING HISTORY:

- Solar Parabolic Dish
- 2.75 mm Rocket Assisted Projectile (RAP)



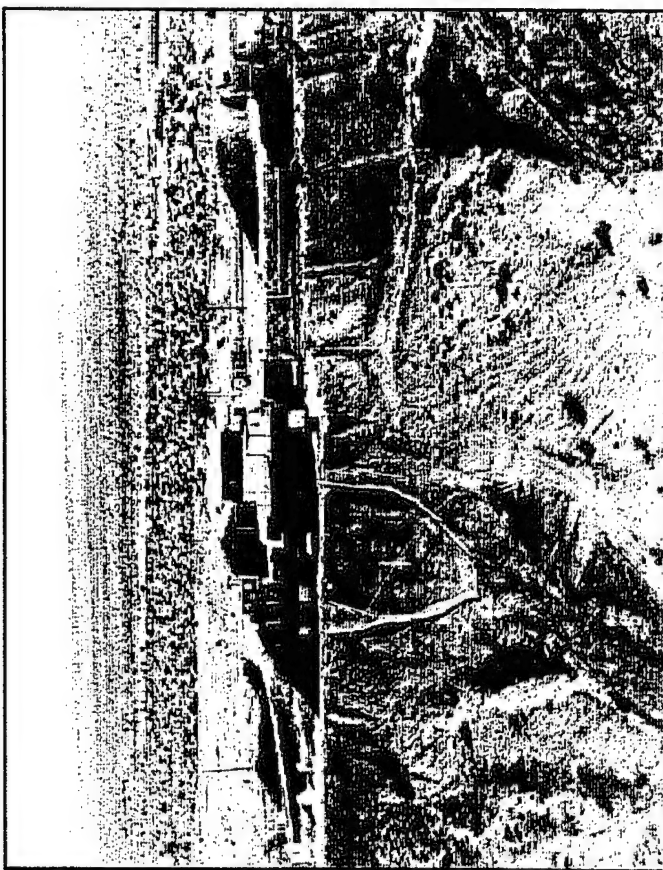
Solid Propellant Preparation Cutting and Aging Facility, Area 1-21

GENERAL AREA CAPABILITIES:

- Originally Designed to Test Liquid Rocket Engines for Research Aircraft (X-15, X-1, X-2)
- 6,000 psi GN2 Cross Country Line
- 12 Inch Water Main
- 440 VAC Facility Power
- Mechanical Shop With 2 Ton Crane

TEST CELL CAPABILITIES:

- Cell 1 - 425 lbs. of 1.1 Solid Propellant
 - Prepare Tensile Test Specimens
- Cell 2 - 100 lbs. of 1.1 Solid Propellant
 - Rough Cutting Large Pieces of Propellant
- Cell 3 - 50 lbs. of 1.1 Solid Propellant
 - Explosion Resistant Window
- Cell 4 - Office / Control Room for Cells 1, 2, and 3
- Cell 5 - 75 lbs. of 1.1 Solid Propellant
 - Initial Weighing, Measuring, and Trimming
 - Fragmentation Testing
- Cell 6 - Control Room for Cells 5 and 7
- Cell 7 - 425 lbs. of 1.1 Solid Propellant
 - 4 Environmental Aging Chambers
- Cell 8 - 20 lbs. of 1.1 Solid Propellant
- Cell 12 - 100 lbs. of 1.1 Solid Propellant
 - Environmental Propellant Storage



TESTING HISTORY



Solid Propellant Laboratory Complex

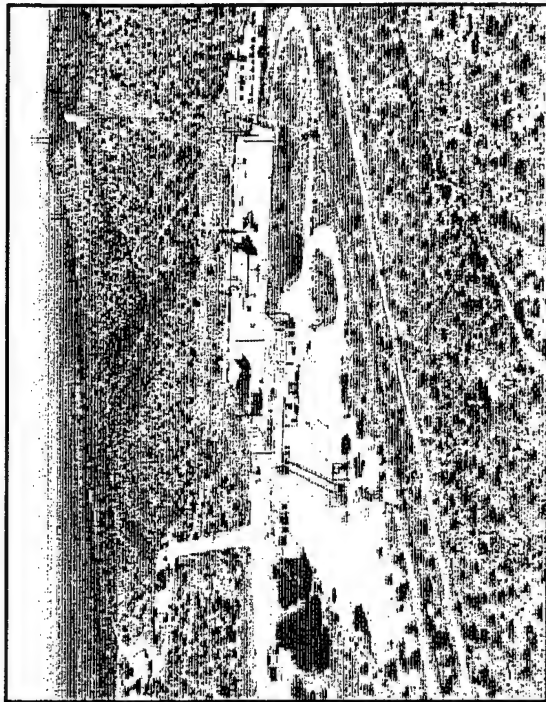
Area 1-30

GENERAL AREA CAPABILITIES:

- Designed to Formulate, Mix, Cast, Cure and Study, High Energy Propellants
- Environmental Conditioning
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
 - 50,000 Gallon Water Storage
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
- Over 30 Mechanical Shop Buildings, Preparation Cells, and Test Stands

COMPLEX CAPABILITIES:

- Propellant Storage Bunkers, 10 Each
 - Maximum 5,000 lb of 1.1 Propellant
- Propellant Aging Cells, 12 Each
 - Heat and Humidity Controlled
- Propellant Processing Cells, 11 Each
 - Processing Propellants, Binders, and Plasticizers
 - Maximum of 100 lb of 1.1 Propellant per Cell
- Propellant Evaluation Facility,
 - Tensile Testing
 - Strand Burning
- Propellant Test Stands and Cells



TESTING HISTORY:

- Microwave Burner 1986 - 1987
- Combustion Stability 1983 - 1987
- Sidewinder Reduced Smoke
- Maverick Reduced Smoke
 - Rotating Valve 1981
 - 20mm RAP 1973
 - Titan Failure Study 1986
- 40mm RAP 1972
- 30mm RAP 1974
- PeaceKeeper Stage I 1976
- PeaceKeeper Stage II 1976
- PeaceKeeper Stage II Failure Study 1982
- PeaceKeeper Stage III Failure Study 1985
- HMX Studies (Hardened structure Munitions) 1974



Solid Propellant Laboratory Complex

Area 1-30

GENERAL AREA CAPABILITIES:

- Designed to Formulate, Mix, Cast, Cure and Study, High Energy Propellants
- Environmental Conditioning
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
 - 50,000 Gallon Water Storage
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
- Over 30 Mechanical Shop Buildings, Preparation Cells, and Test Stands

COMPLEX CAPABILITIES:

- Propellant Storage Bunkers, 10 Each
 - Earth Covered Bunker
 - Above Ground Bunker
 - Maximum 5,000 lb of 1.1 Propellant
- Propellant Aging Cells, 12 Each
 - Heat and Humidity Controlled
 - From (-65 to +500) Degrees F
- Propellant Processing Cells, 11 Each
 - Processing Propellants, Binders, and Plasticizers
 - Speed and Temperature Controlled Mixers
 - Blast Proof Windows or Remote Television Monitors
 - Maximum of 100 lb of 1.1 Propellant per Cell

» Some Limited to 25 lb

COMPLEX CAPABILITIES (Cont):

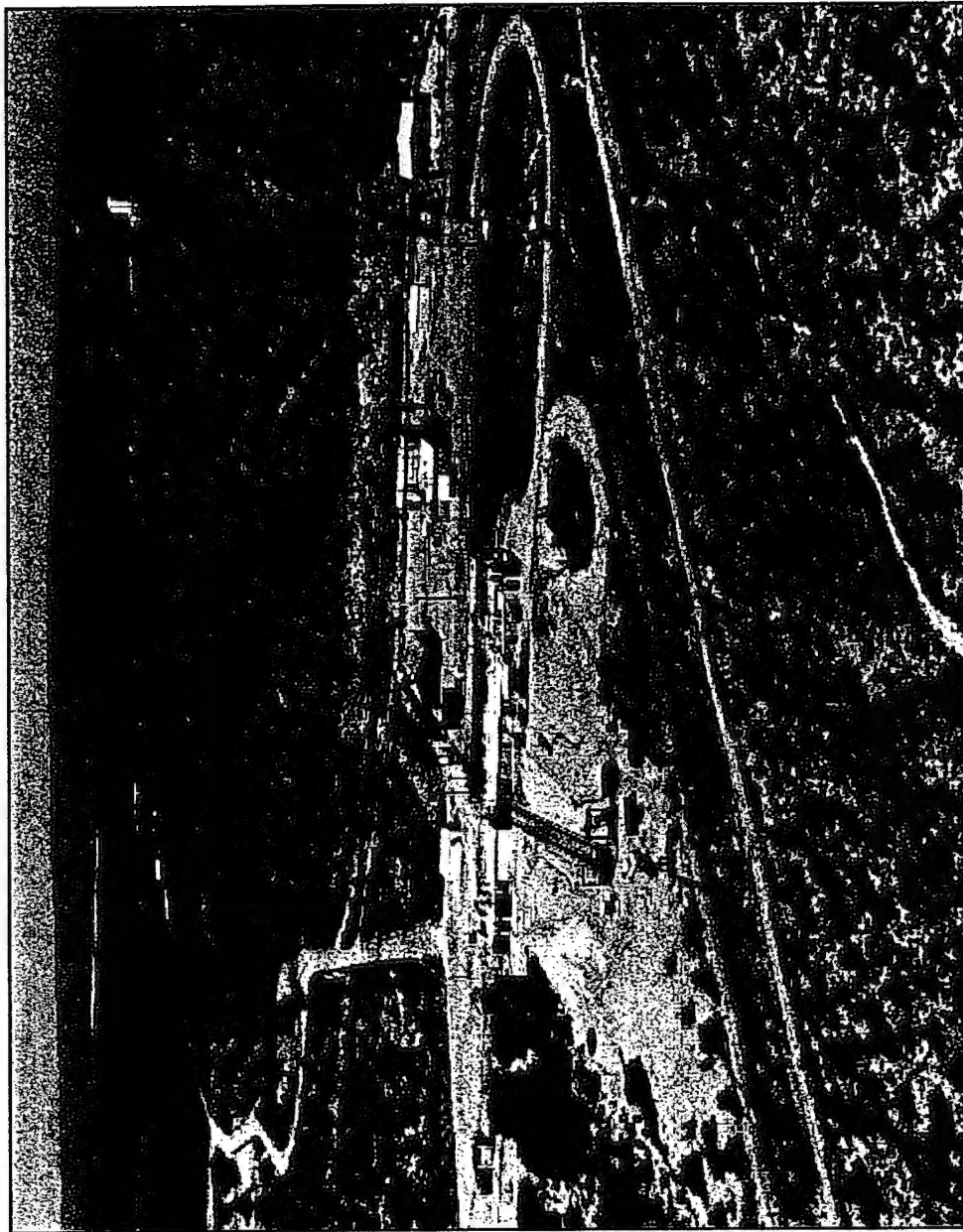
- Propellant Evaluation Facility
 - Tensile, Friction, and Drop Weight Testing
 - Rheometrics Mechanical and Stress Spectrometers
 - Strand Burning
- Propellant Test Stands and Cells
 - Test Cell 25
 - Pulling and Twisting Tensile Tester
 - Test Cell 26
 - Combustion Bomb Window
 - Test Cell 27
 - 60,000 Volt Electrostatic Discharge Testing
 - Test Stand 34
 - Fluid Energy Mill
 - Test Stand 44
 - Propellant Burn Sensitivity

TESTING HISTORY:

- 20, 30, 40mm RAP 1972-1974
- Sidewinder
- Maverick
- Rotating Valve 1981
- Rotating Valve 1976-1985
- Combustion Laser
- Titan
- HMX Studies (Hardened Structure Munitions) 1974

Solid Propellant Laboratory Complex

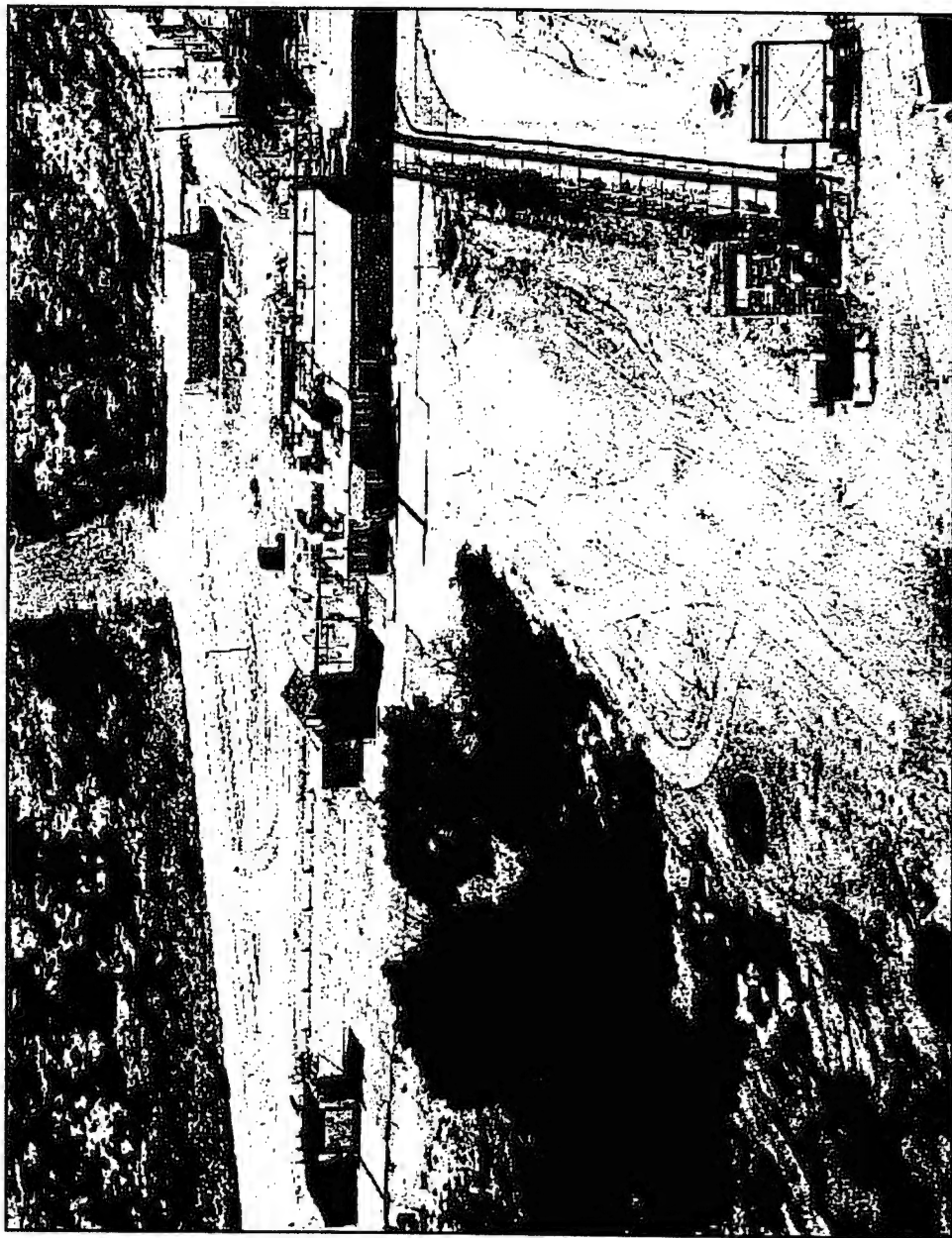
Area 1-30





Solid Propellant Laboratory Complex

Area 1-30



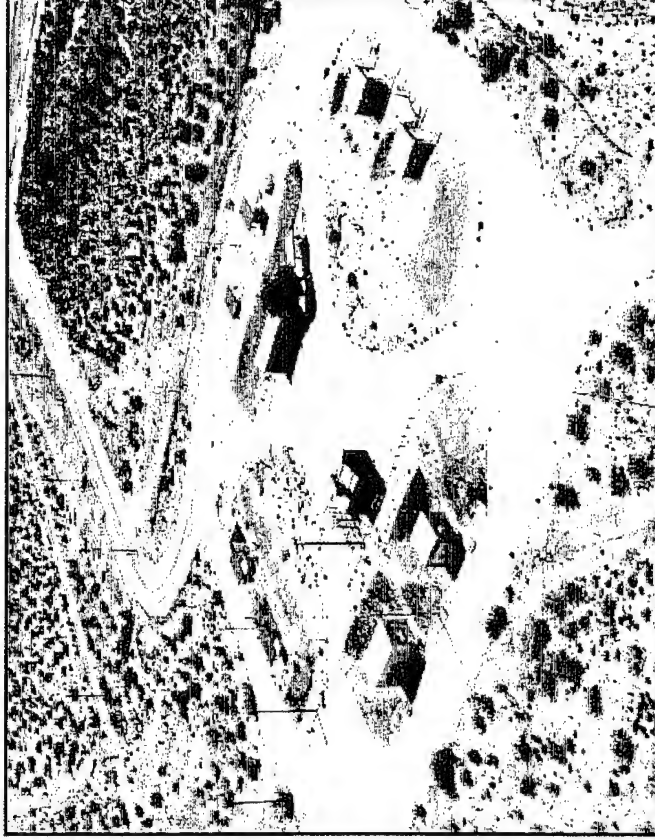


Propellant Aging Cells Area 1-30

D2318A 021

CELL CAPABILITIES:

- Ground Level 12 Environmental Aging Cells
 - Each Cell is Approximately 64 Cubic Feet
 - Temperature Control From -65 to +500 Degrees F.
 - Humidity Control
- 2,400 lb of 1.1 TNT Equivalent Propellant Total for 12 Cells
- Remote Environmental Conditioning System
 - Data Acquisition and Health Monitoring



TESTING HISTORY:



Motor Component Complex

Area 1-32

GENERAL AREA CAPABILITIES:

- Plume Diagnostics Analysis System
- High Hazard Motor / Propellant Testing
- Hydrogen Injector System
- Environmental Conditioning
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
- Mechanical Shop With 2 Ton Crane
- Receiving and Inspection Station

— With 50 Ton Crane

— With Environmental Conditioning

TEST STAND CAPABILITIES: (CURRENT CONFIGURATION)

- Pad 1 - 250,000 Lbf Thrust, Horizontal
- Pad 2 - 150,000 Lbf Thrust, Horizontal
- Pad 3 - 10,000 Lbf Thrust, Horizontal
- Pad 5A / 5B / 5C - 36,000 Lbf Thrust, Horizontal



TESTING HISTORY:

- Sidewinder • Minuteman • Sparrow
- Shuttle • PeaceKeeper • HIPPO
- Small ICBM • Taurus • Titan
- Hydrogen Augmented Solid Rockets
- Ammonium Perchlorate



Motor Component Complex

Area 1-32

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 64 Channel Data Acquisition System and 128 Channel Control System
- Mechanical Shop With 2 Ton Crane
- Receiving and Inspection Station
 - With 50 Ton Crane
 - With Environmental Conditioning

TEST STAND CAPABILITIES:

- Ground Level Testing
- Environmental Conditioning
- PAD 1 - Maximum Thrust 1,000,000 lbf.
 - (Current Configuration) 250,000 lbf. Thrust
 - 10 Ton Overhead Crane, 7,000 lb of 1.1 or 50K of 1.3 Solid Propellant
- PAD 2 - Maximum Thrust 1,000,000 lbf.
 - (Current Configuration) 150,000 lbf. Thrust
 - 15 Ton Overhead Crane, 7,000 lb of 1.1 or 50K of 1.3 Solid Propellant

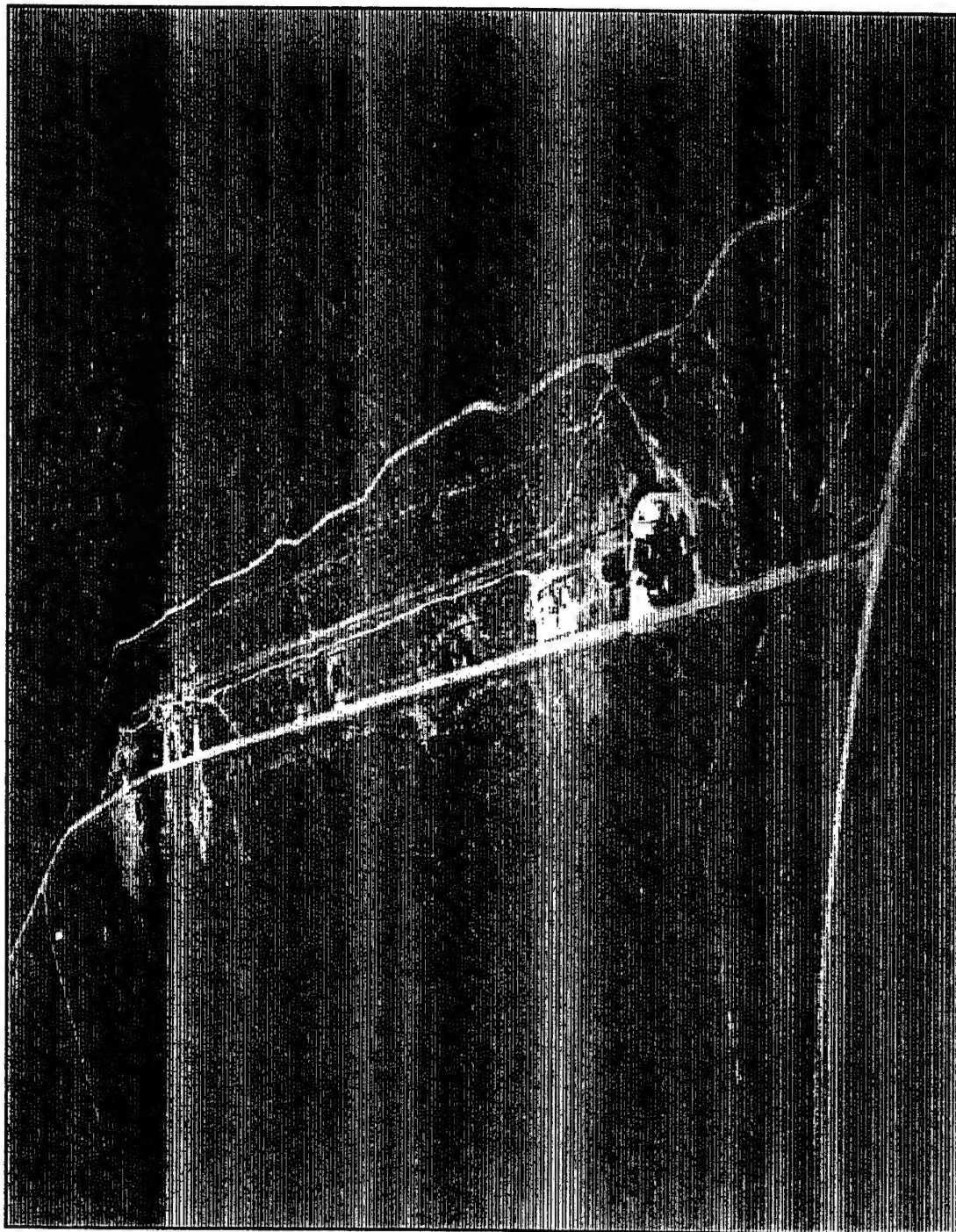
TEST STAND CAPABILITIES:

- PAD 3 - Maximum Thrust 60,000 lbf.
 - (Current Configuration) No Thrust, 1,000 lb of 1.1 or 5K of 1.3 Solid Propellant
 - High Hazard Motor / Propellant / Gun Testing
- PAD 5A / 5B / 5C - Maximum Thrust 36,000 lbf.
 - 70 lb of 1.1 or 180 lb of 1.3 Solid Propellant
 - Onboard Automatic Calibration System 99.9% Accuracy
- Pad 5A (Current Configuration) 12,000 lb Thrust,
 - Plume Diagnostics Analysis System
- Pad 5B (Current Configuration), 10,000 lb Thrust
- Pad 5C 36,000 lbf. Thrust, Spin Capability,
 - Hydrogen Injection System

TESTING HISTORY:

- Sidewinder
- Sparrow
- Ammonium Perchlorate
- Small ICBM
- Minuteman
- Hydrogen Augmented Solid Rockets
- Minuteman
- PeaceKeeper
- Pegasus
- 30mm RAP
- Shuttle
- Taurus
- Durandahl
- HIPPO
- 20mm RAP

Motor Component Complex Area 1-32



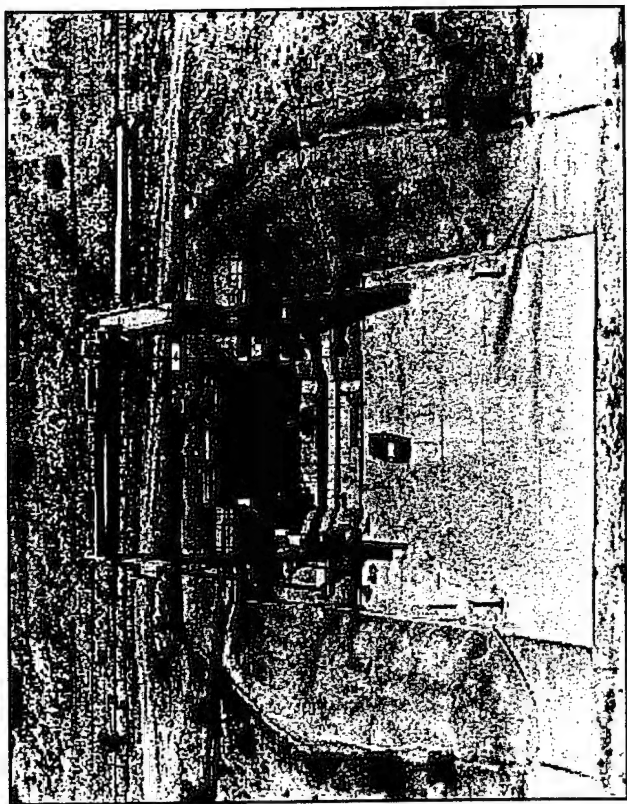


Large Motor Test Stand

Area 1-32 Test Stand 1

TEST STAND 1 CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 1,000,000 lbf. Horizontal or Vertical
 - (Current Configuration) 250,000 lbf. Thrust
 - Horizontal, Six-Component, Automatic Calibration
 - 25,000 lbf. Side Force
- 30' x 45' Concrete Pad
- 7,000 lb of 1.1 or 50,000 lb of 1.3 Solid Propellant
- Environmental Enclosure (Temperature / Humidity)
- 10 Ton Traveling Overhead Crane



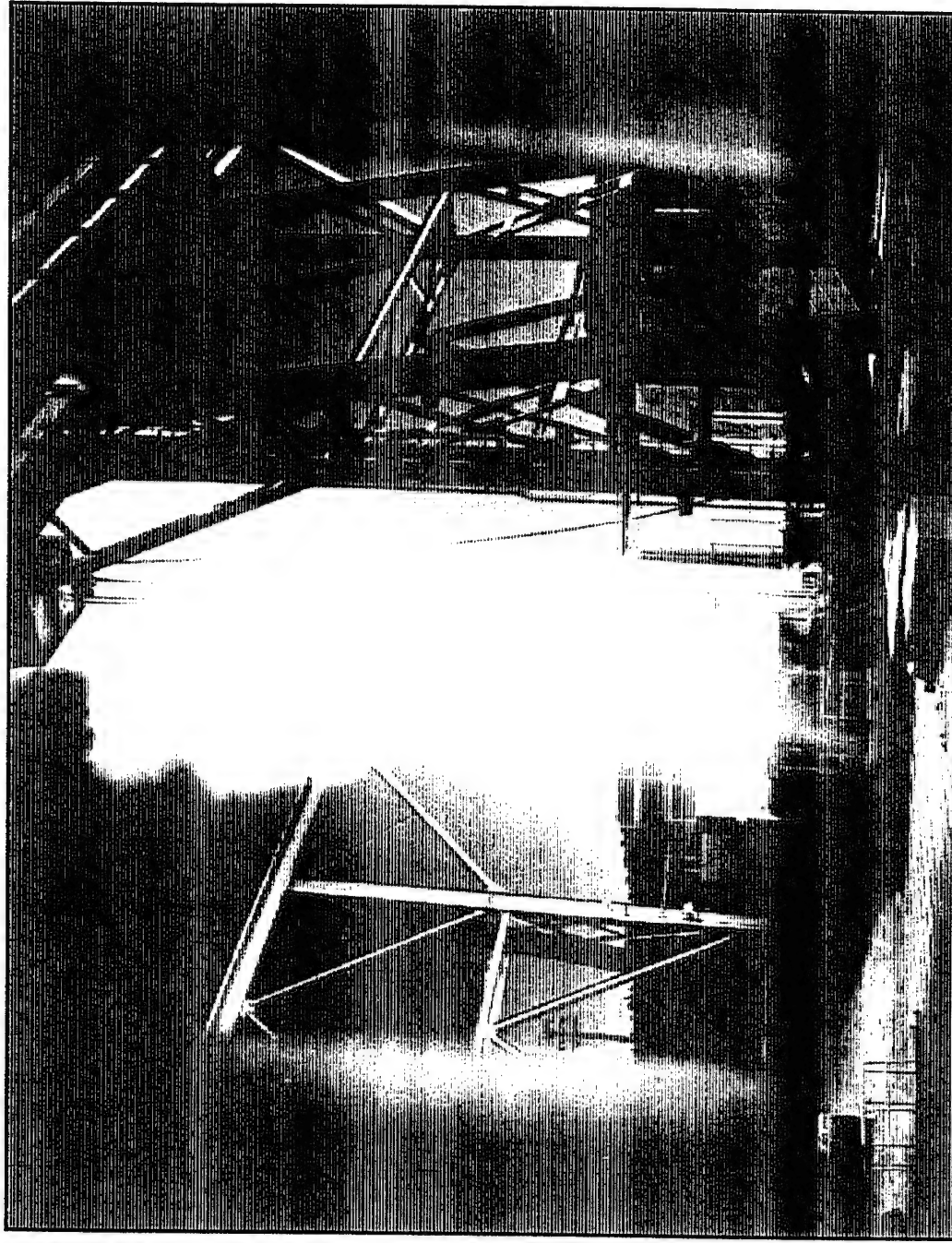
TESTING HISTORY:

- Minuteman
- Titan
- PeaceKeeper
- Viper
- SuperBATES
- Trident



Large Motor Test Stand Area 1-32 Test Stand 1

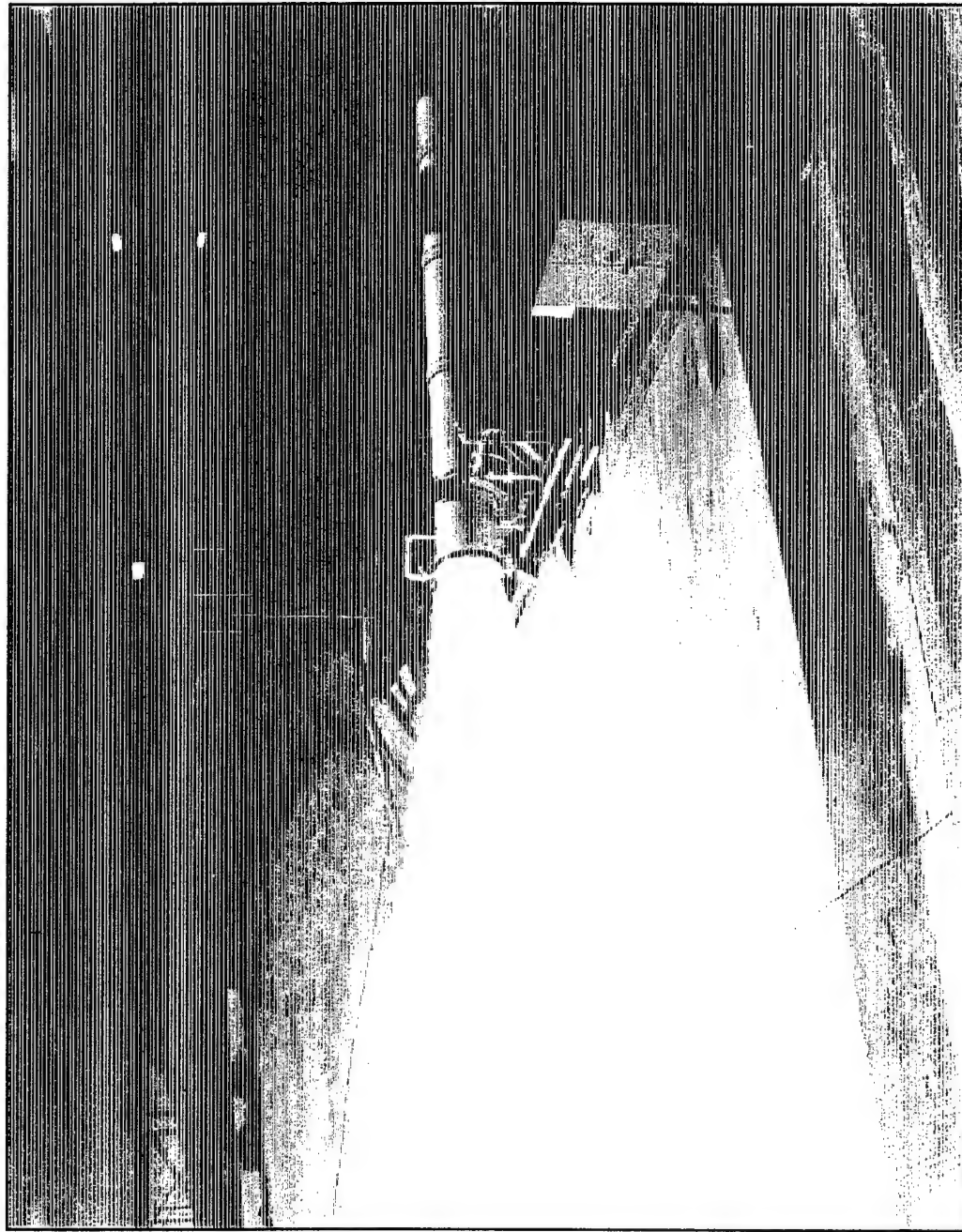
D2318A 026



Thrust Vector Control (TVC) Test



Large Motor Test Stand Area 1-32 Test Stand 1



Nozzleless Booster 1985



Large Motor Test Stand

Area 1-32 Test Stand 2

D2318A 028

TEST STAND 2 CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 1,000,000 lbf. Horizontal or Vertical
 - (Current Configuration) 150,000 lbf. Thrust
 - Horizontal Single Axis, Automatic Calibration
 - 99.85 % Thrust Measurement Accuracy
 - 1 to 4 Segments, up to 34 inch Diameter
- 30' x 45' Concrete Pad
- 7,000 lb of 1.1 or 50,000 lb of 1.3 Solid Propellant
- Environmental Enclosure (Temperature / Humidity)
- 15 Ton Traveling Overhead Crane



TESTING HISTORY:

- High Internal Pressure Producing Orifice (HIPPO)
- Small ICBM (TVC Shoot Off)
- 84" Diameter, Materials Testing Motor (CHAR)



High Hazards Test Stand

Area 1-32 Test Stands 3A, B, C, & D

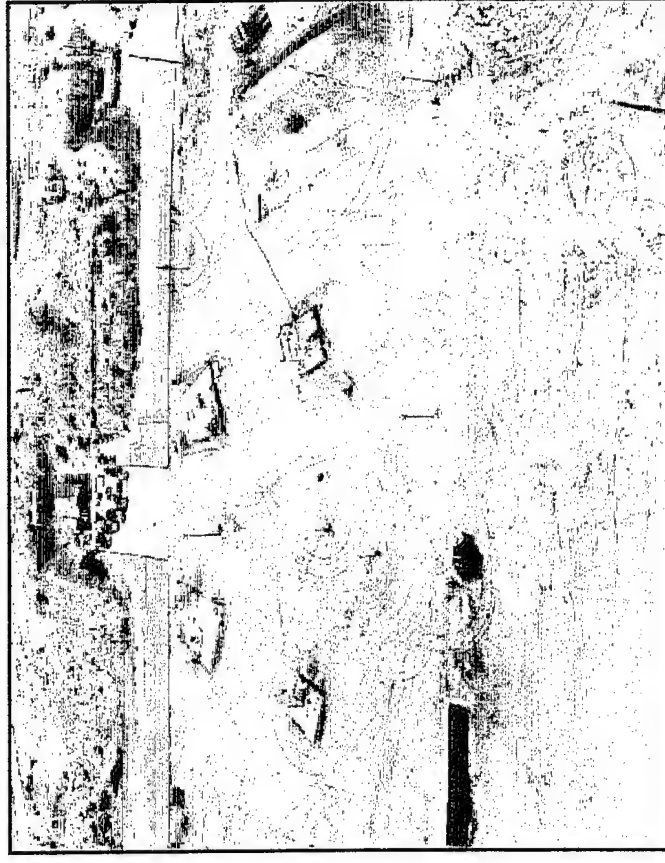
D2318A 029

TEST STANDS CAPABILITIES:

- Maximum Thrust 10,000 lbf, Horizontal
- (Current Configuration) No Thrust
- 1,000 lb of 1.1 or 5,000 lb of 1.3 Solid Propellant
- 2 Ton Traveling Overhead Crane
- Gun Target

TESTING HISTORY:

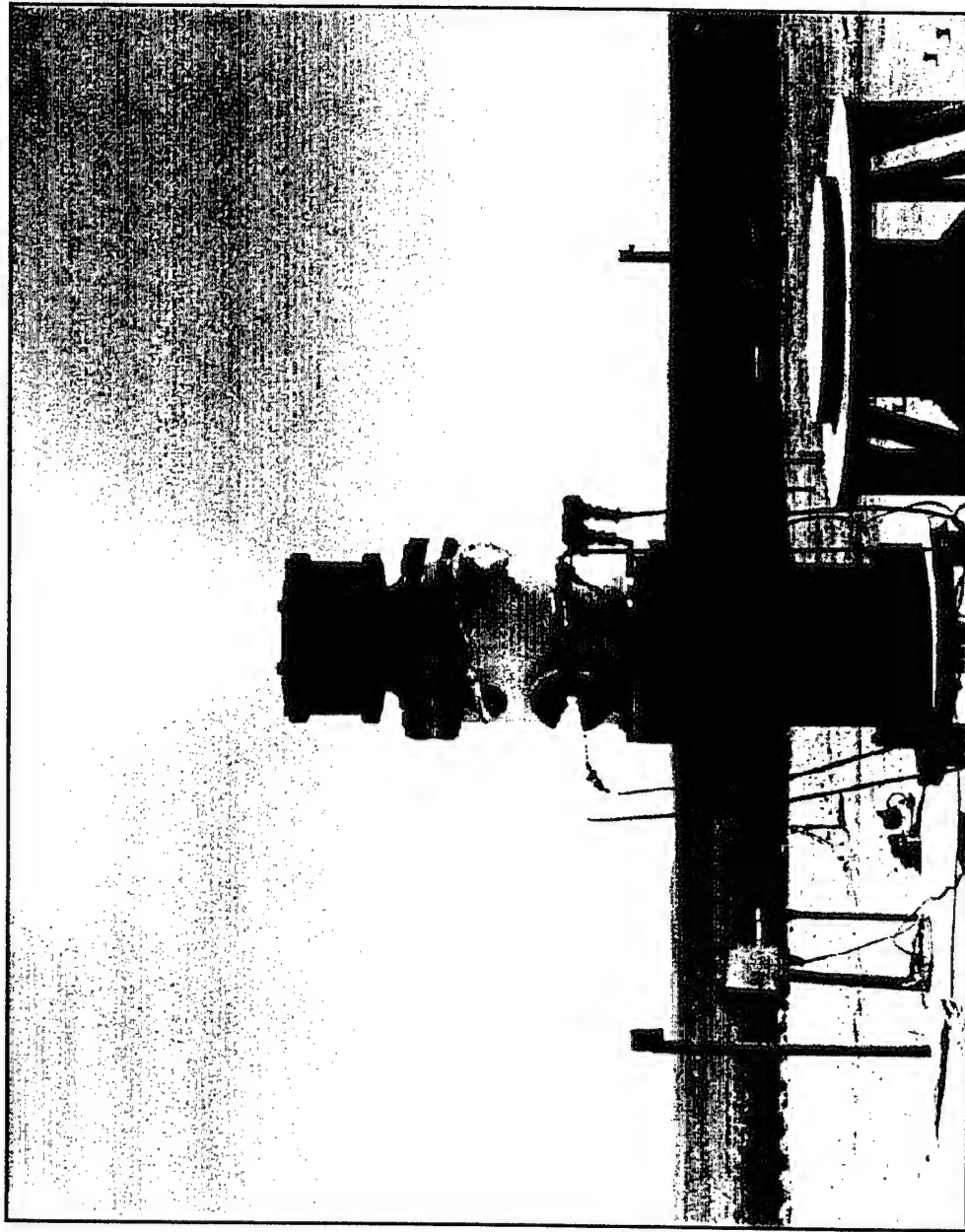
- Sidewinder
- 30mm RAP
- Ammonium Perchlorate
- Hot Gas Valve • Durandahl
- F16 Emergency Hydrazine Generator
- Minuteman Critical Diameter Definition
- Sparrow
- 20mm RAP





High Hazards Test Stand

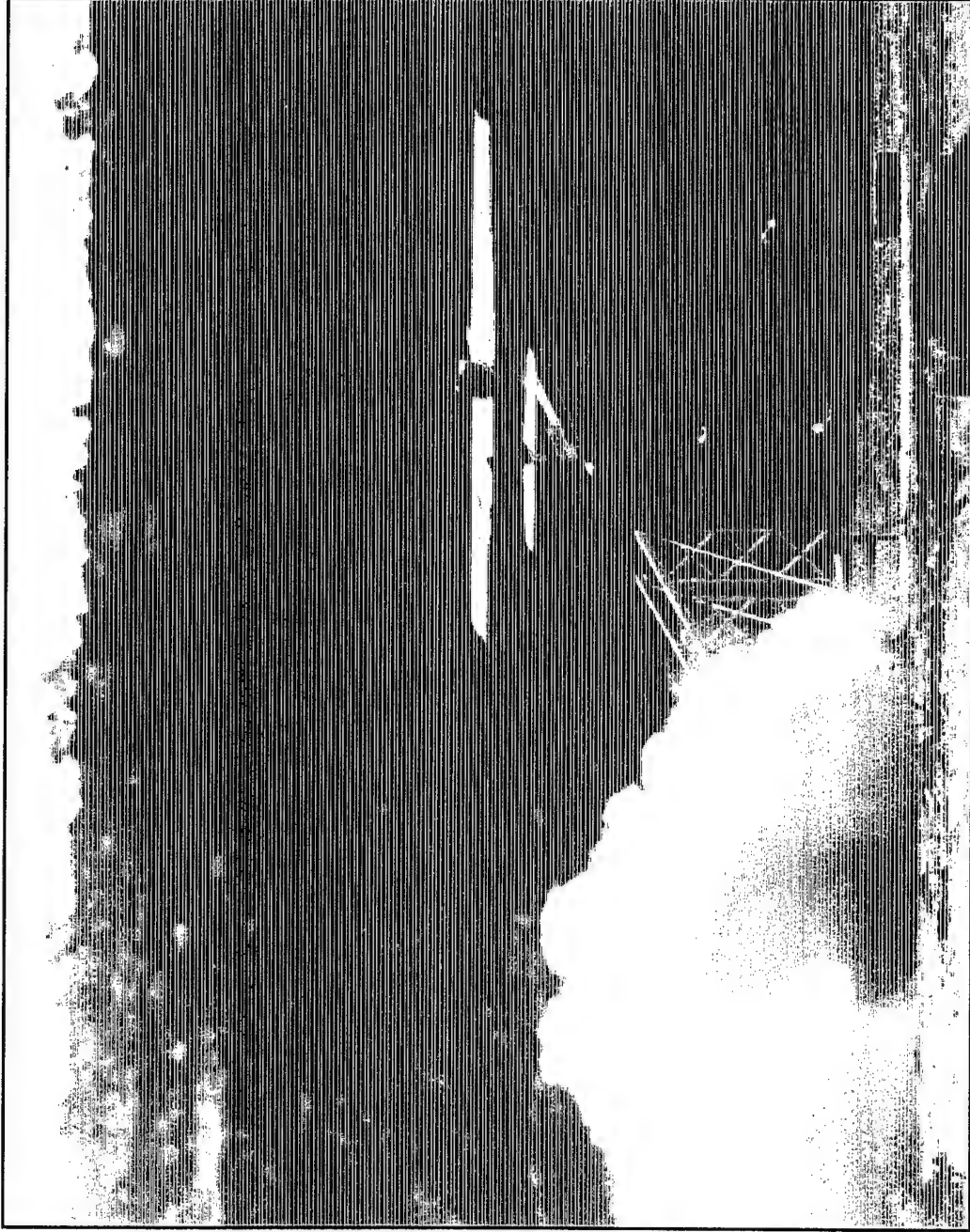
Area 1-32 Test Stand 3A



Integrated Stage Thrust Vectoring Test, 1982

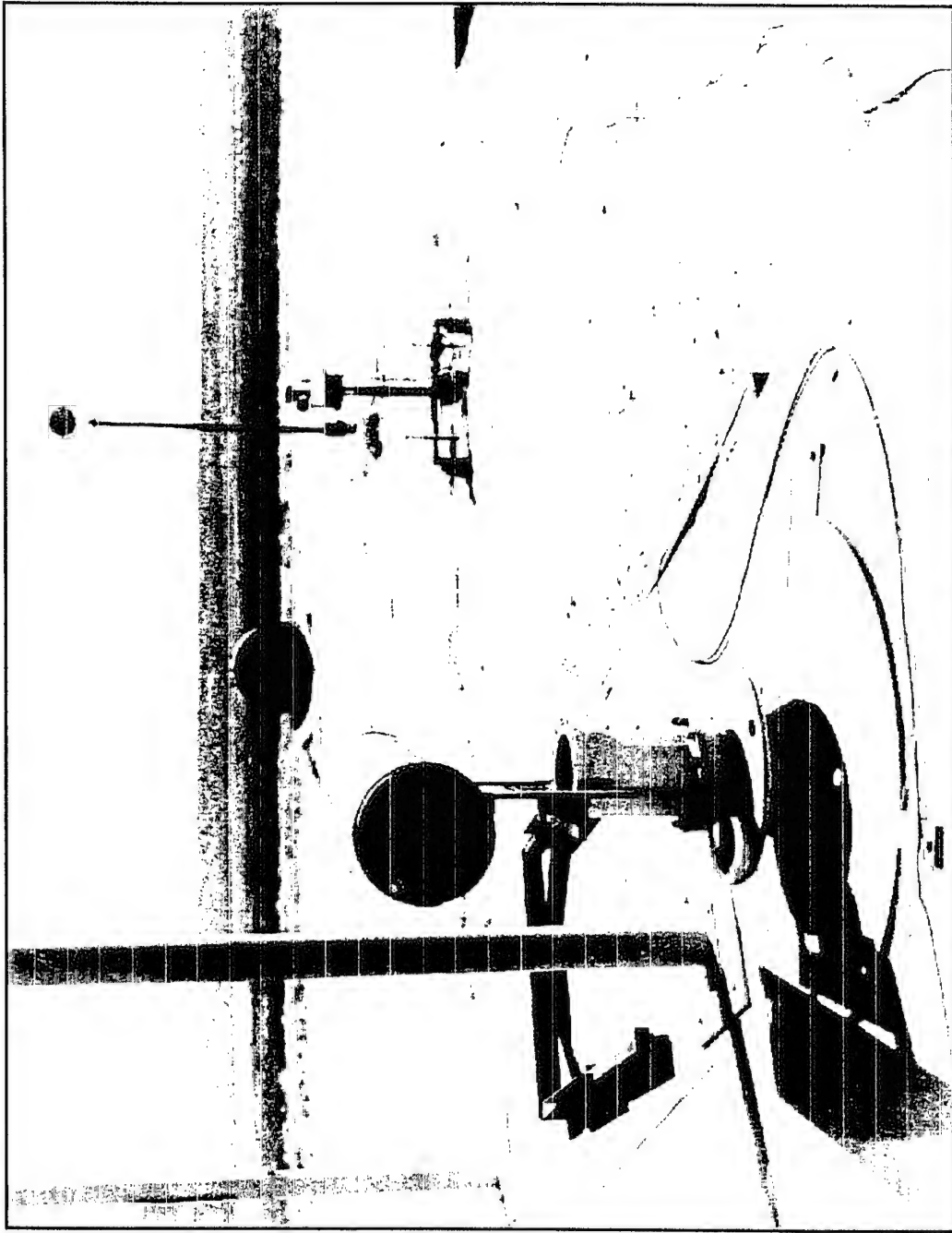


High Hazards Test Stand 3A Test Area 1-32



REMOTELY PILOTED VEHICLE

High Hazards Test Stand 3A Test Area 1-32



30mm ROCKET ASSISTED PROJECTILE (RAP)



15 & 70 lb BATES Motor Pads - Area 1-32 Pads 5A, 5B, & 5C

TEST STAND CAPABILITIES:

- 12K, 10K, 36K lbf Thrust Stands Horizontal
- 70 lb of 1.1 or 180 lb of 1.3 Solid Propellant
- Onboard Automatic Calibrating System 99.9% Accuracy
- One to Four Segments, Up to 14 Inch Diameter
- Test Stand 5A (Current Configuration) 12,000 lb Thrust

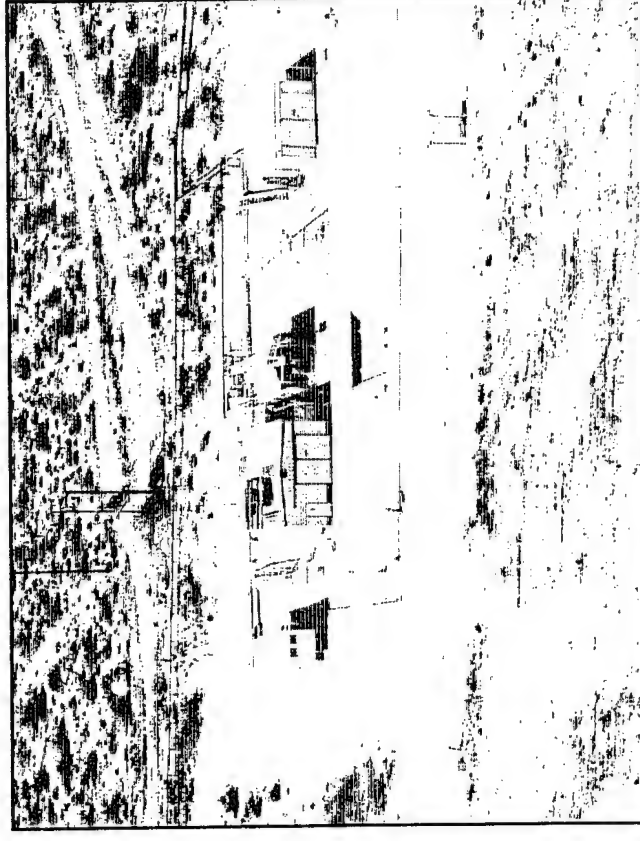
• Plume Diagnostics System

- Mean Particle Sizing
- Particle Capture
- Visible UV & IR
- Thermal Image Recording
- 3 Wideband IR Radiometers

— Near IR Fourier Transform Spectrometer

- Test Stand 5B (Current Configuration) 10,000 lb Thrust
- Test Stand 5C (Current Configuration) 36,000 lbf. Thrust

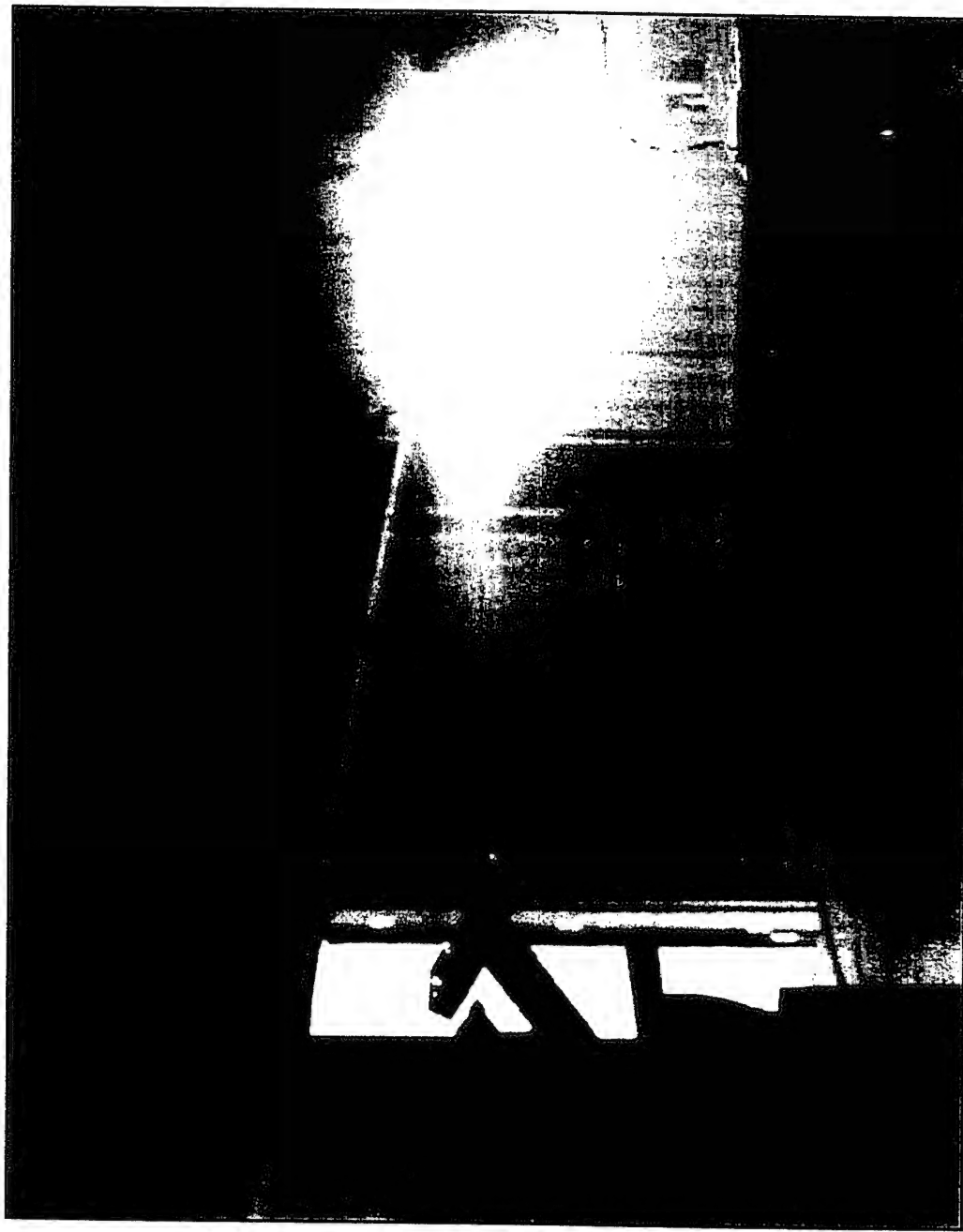
- Motor Spinning Capability
- Hydrogen Injection System



TESTING HISTORY:

- Sidewinder
- Sparrow
- Shuttle
- Minuteman
- Durandahl
- Hydrogen Augmented Solid Rockets
- Titan
- PeaceKeeper
- Small ICBM
- 30mm RAP
- 20mm RAP
- Ammonium Perchlorate

BATES Motor Pad Area 1-32, Pad 5A



15 lb Bates / Plume Test



Motor Behavior Complex

Area 1-36

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 2 Foot Water Main
- 440 VAC and 28 VDC Stand Power
 - Accessible for A and B Pads, Available for D Pad
- Mechanical Shop
 - With 2 Ton Traveling Overhead Crane

TEST STAND CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- 1-36A Pad, Maximum Thrust, 4M lbf., Horizontal
 - 1M Lbs TNT Equivalent
- 1-36B Pad, Inactive
- 1-36D Pad, Explosive Detonation Studies
 - 1M Lbs TNT Equivalent

TESTING HISTORY:

- PeaceKeeper Flight Termination Guidance
 - Stage I / II / III 1980 -
- PeaceKeeper Advanced Development Program
- Titan III, 120 Inch Solid
- Ammonium Perchlorate
- Silo Fire Safety
- Solid Propellant Hazards Study (SOPHY)



Motor Behavior Complex

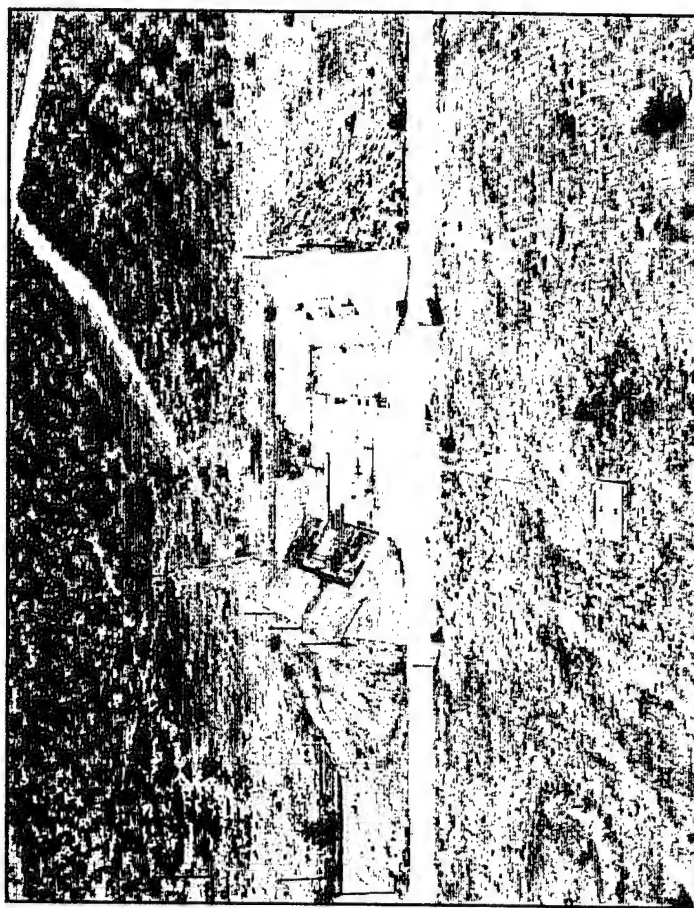
Area 1-36, Horizontal Test Pad A

TEST STAND CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- Horizontal Bermed Bare Pad
- Maximum thrust, 4M lbf.
- 1M Lbs TNT Equivalent
- Would Require New Data Acquisition and Control Facility

TESTING HISTORY:

- PeaceKeeper Flight Termination Ordinance Stage I / II 1980 -
- PeaceKeeper Ordnance Advanced Development Program
- Titan III, 120 Inch Diameter, Solid Strap On
- Minuteman Stage II
- Minuteman Stage III





Motor Behavior Complex Area 1-36, Vertical Test Pad B

D2318A 037

TEST STAND CAPABILITIES:

- Ground Level Testing
- 1-36B Pad, Inactive

TESTING HISTORY:

- Titan III, 120 Inch Diameter, Solid Strap On





Motor Behavior Complex

Area 1-36, Detonation Test Pad D

1-36D FACILITY CAPABILITIES:

- Data Acquisition and Control System
 - 24 Channel High-Speed Le Croy Digital Recorder, 300mHz
 - 28 Channel High-Speed, Frequency Modulated Tape Recorder
 - IBM PC Based LABVIEW Control System

TEST STAND CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- Detonation, High Hazard, and Explosive Studies
- 200 Foot Diameter Cleared Ground Pad
- 1-36D Pad, Maximum Explosive Capability
 - 1M Lbs TNT Equivalent
- Ignition System
 - Standard 28 VDC
 - 5,000 VDC Explosive Bridgewire Circuit



TESTING HISTORY:

- PeaceKeeper Flight Termination Stage III
- Ammonium Perchlorate
- Silo Fire Safety
- Space Launch Safety Studies
- Solid Propellant Hazards Study (SOPHY)
- Tool Drops on Minuteman Stage III



Motor Behavior Complex Area 1-36, Detonation Test Pad D



SuperHIPPO Motor Impact Studies 1992

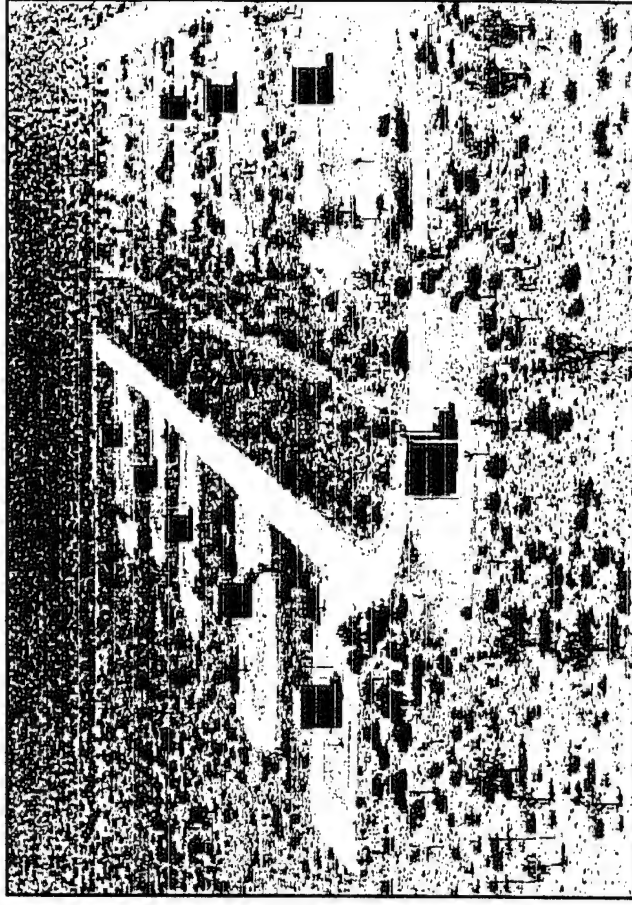


Propellant Storage Area Area 1-38

D2318A 040

GENERAL CAPABILITIES:

- 9 Storage Buildings
 - Each Building 24 Foot x 31 Foot
 - 20 Foot Vertical Clearance
- Sited for 50,000 Lbs of 1.1 or 200,000 Lbs of 1.3 TNT Equivalent Propellant
- Environmental Capability
 - Temperature
 - Humidity





Liquid Propellant Aging Facility

Area 1-40

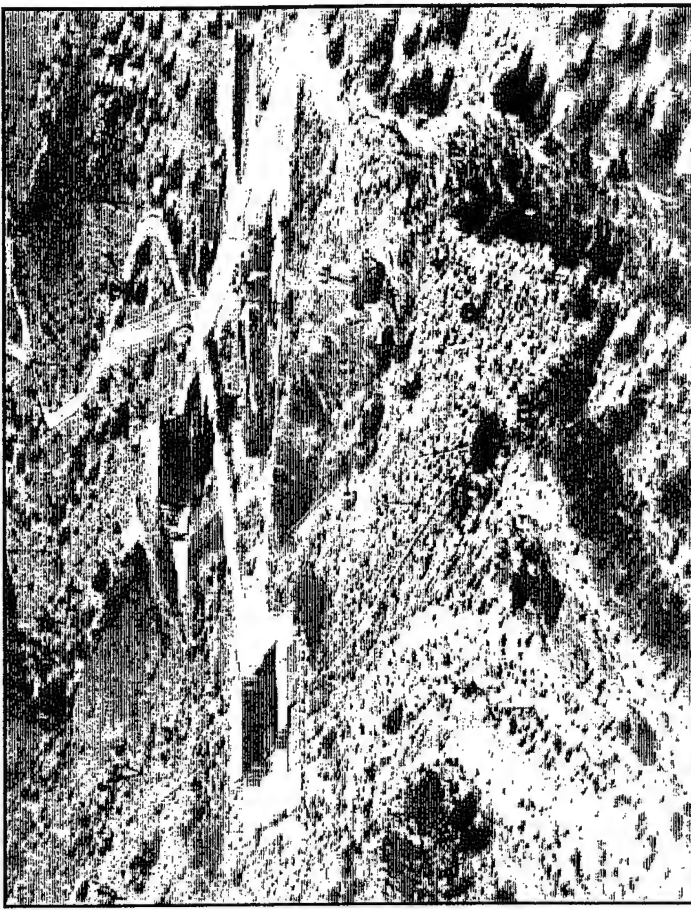
D2318A 041

GENERAL AREA CAPABILITIES:

- Propellants Have Been Stored Since 1971
- 1,500 psi GN2 Cross Country Line
- 12 Inch Water Main
- 440 VAC Facility / Stand Power
- Mechanical Shop

TEST STAND CAPABILITIES:

- Pad A / B - Maximum Thrust 5,000 lbf.
 - (Current Configuration) Inactive
 - No Thrust Stand
 - 2 Ton Overhead Crane Railing
- Pad C / D - Maximum Thrust 50,000 lbf.
 - (Current Configuration) Inactive
 - No Thrust Stand
 - 2 Ton Overhead Crane Railing
- Mechanical Shop Aging Building
- Liquid Propellant Long Term Storage Studies
 - CLF5 -- CLF3
 - N2O4
- Firex System
- Portable Heating and Air Conditioning



TESTING HISTORY

- Bi-Propellant Oxidizer Feed System
- Tank Storability



Space Environment Propulsion Complex

Area 1-42

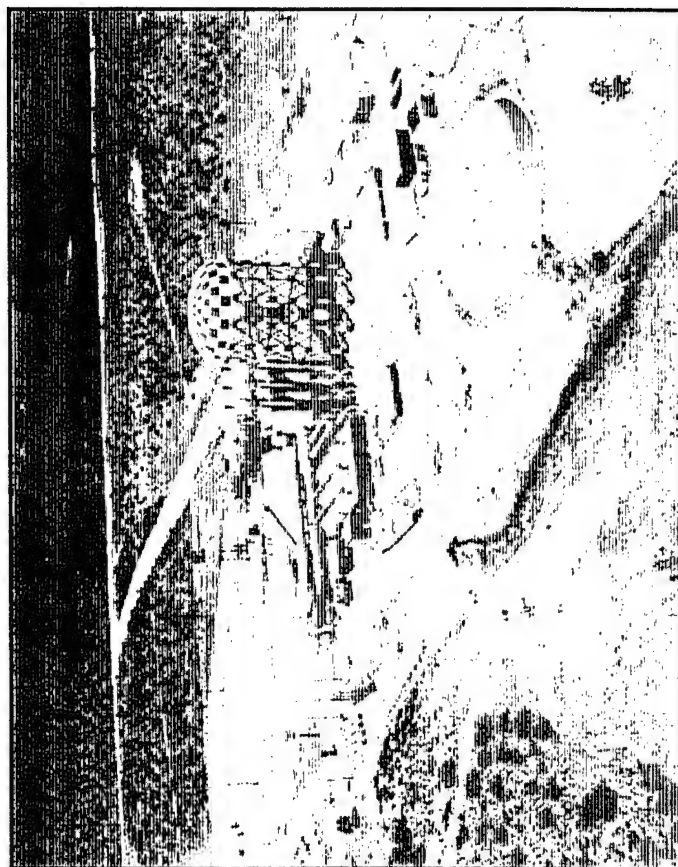
GENERAL AREA CAPABILITIES:

- Propane-Fired Steam / Vacuum System
 - Altitude Simulation to 125,000 Feet (A,B,D Cells)
 - Up to 1800 Seconds Duration
 - Mass Flow 600Lb/Sec EWA 70
- Mechanical Pumped Vacuum Systems
 - Altitude Simulation to 125,000 Feet E Cell
 - Altitude Simulation to 650,000 Feet SPEF Chamber
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
 - 192 Channel, 100,000 Sample Per Second, Data System
 - 256 Channel Programmable Logic Control System
- Mechanical Shop With 2 Ton Crane

TEST STAND CAPABILITIES:

(CURRENT CONFIGURATION)

- Altitude Simulated Testing
 - A Cell - 60,000 lbf. Thrust, Horizontal
 - D Cell - 20,000 lbf. Thrust, Horizontal
 - B Cell - 50,000 lbf. Thrust, Vertical
- SPEF Chamber, No Thrust



TESTING HISTORY

- Trident
- XLR-132
- Minuteman III
- MSTI I / II / III
- KEW (Kinetic Energy Weapon)
- High Altitude Supersonic Target (HAST)
- TRSM Navy Third Stage Rocket Motor 1997
- Star 30
- Centaur
- Composite Polar Boss
- Viper
- Hughes TTM/STM
- Gossamer Structures
- ASAS
- EEC
- Small ICBM
- StarTech



Space Environment Propulsion Complex

Area 1-42

GENERAL AREA CAPABILITIES:

- Propane-Fired Steam / Vacuum System
 - 3 Parallel Stage, Ejectors, 9 Steam Bottles
 - 125,000 Feet Simulated Altitude (A,B,D Cells)
 - Up to 1800 Seconds Duration (9 Bottles)
 - Mass Flow Rates Approximately 600 Lb/Sec EWA 70
- Mechanical Pumped Vacuum Systems
 - 125,000 Feet Simulated Altitude E Cell
 - 650,00 Feet Simulated SPEF Chamber
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Data Acquisition and Control System
 - 192 Channel, 100,000 Sample Per Second, Data System
 - 256 Channel Programmable Logic Control System
- Mechanical Shop With 2 Ton Crane

TEST CHAMBER CAPABILITIES:

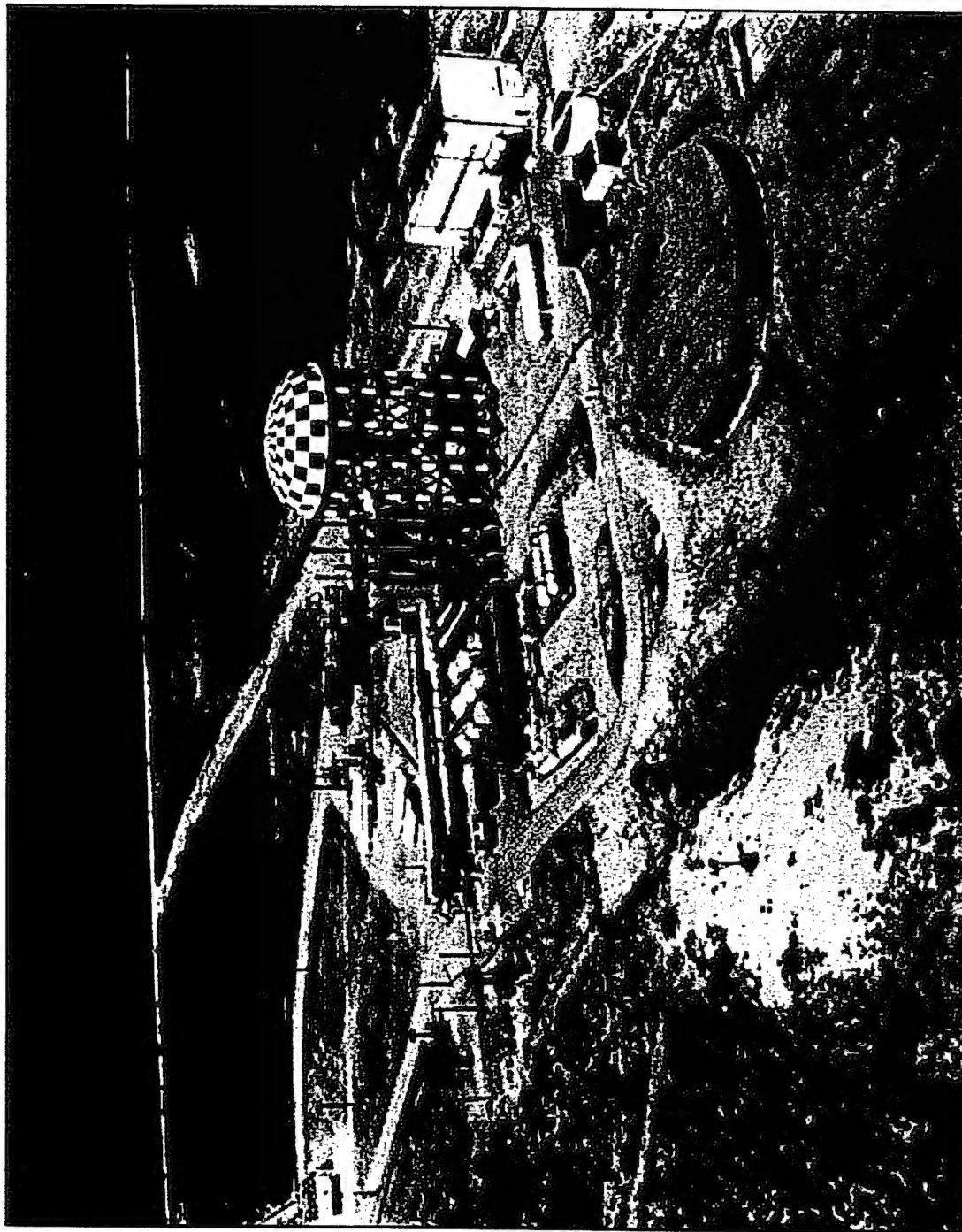
- Altitude Simulation Testing
- Environmental Conditioning
- A Cell - Maximum Thrust 60,000 lbf.
 - Chamber 12 Foot Diameter x 28 Foot Long
 - (Current Configuration) 50,000 lbf. Thrust, Horizontal
 - 66 Inch Diffuser (77 Inch Maximum)
 - Solid Motors up to 66 Inch Diameter x 18 Foot Long
 - 2 Each 5 Ton Overhead Cranes
 - 30K of TNT Equivalent Propellant

TEST CHAMBER CAPABILITIES (Cont):

- D Cell - Maximum Thrust 20,000 lbf.
 - Chamber 10.5 Foot Diameter x 25 Foot Long
 - (Current Configuration) 20,000 lbf.f Thrust, Horizontal
 - No Diffuser (55 Inch Maximum)
 - Solid Motors up to 48 Inch Diameter x 18 Foot Long
 - 5 Ton Overhead Crane
 - 30K of TNT Equivalent Propellant
- B Cell - Maximum Thrust 50,000 lbf.
 - Chamber 16 Foot Diameter x 28 Foot High
 - (Current Configuration) 4,500 lbf. Thrust, Vertical
 - 44 Inch Diffuser (44 Inch Maximum)
 - Solid Motors up to 48 Inch Diameter x 15 Foot Long
 - 30K of TNT Equivalent Propellant
- Chamber
 - Chamber 30 Foot Diameter
 - Solar Simulation
 - LN2 Cryogenic Panels

Space Environment Propulsion Complex

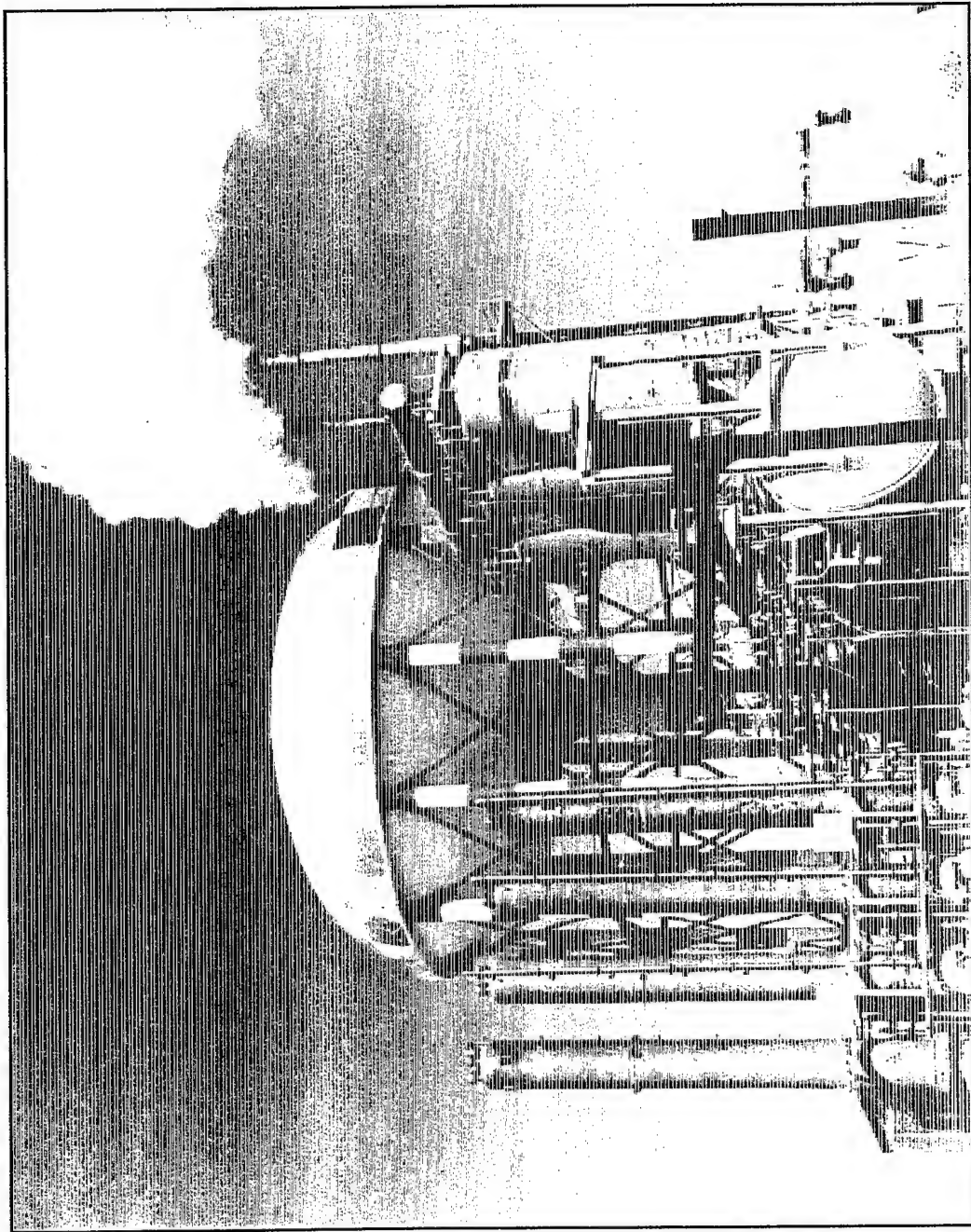
Area 1-42





Space Environment Propulsion Complex

Area 1-42



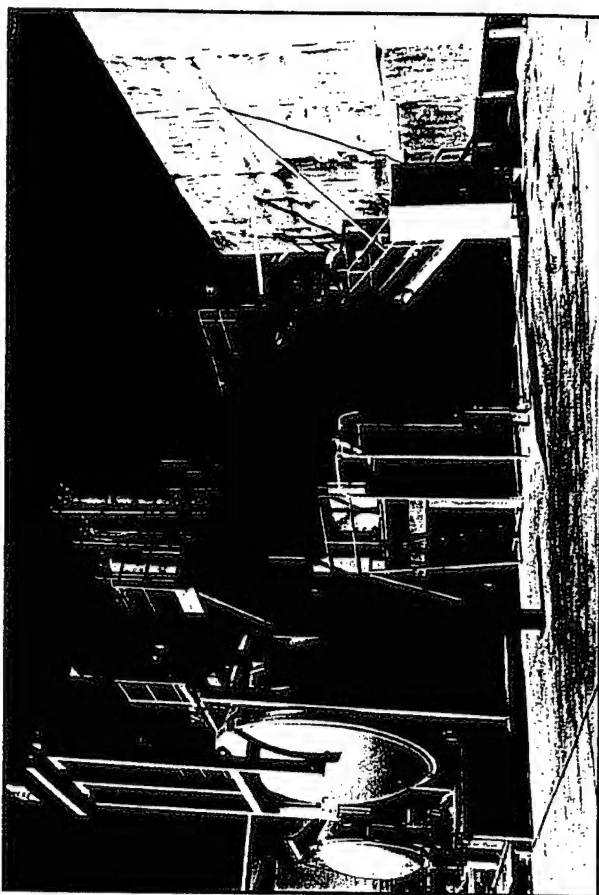
Area Steam Run



Horizontal Test Chamber Area 1-42, A Cell

TEST CHAMBER CAPABILITIES:

- Altitude Simulation to 125,000 Feet
- Maximum Thrust 60,000 lbf., Horizontal
 - (Current Configuration) 50,000 lbf. Thrust, Horizontal
 - Onboard Automatic Calibration System 99.9% Accuracy
 - Motor Spin and IR Measuring Capability
 - Six Component Capability
- Chamber 12 Foot Diameter x 28 Foot Long
 - 2 Each, 5 Ton Overhead Crane
 - Film Camera Portholes and In-Chamber Video
 - 66 Inch Diffuser (77 Inch Maximum)
 - Solid Motors Up to 66 Inch Diameter x 18 Foot Long
- Environmental Conditioning
 - (-30 to + 120 Degrees F)
- 30K of TNT Equivalent 1.1 Class Propellant



TESTING HISTORY

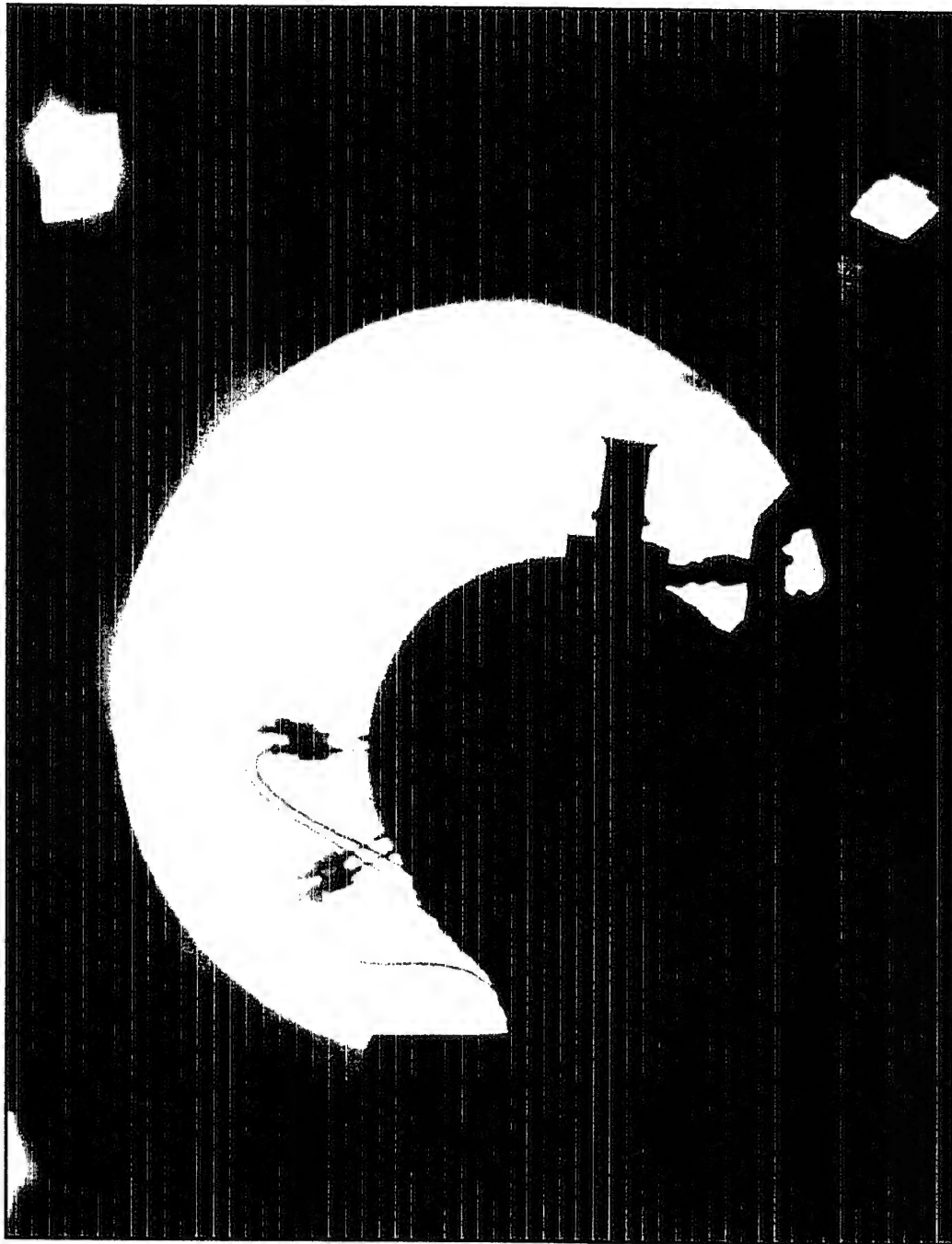
- Trident
- Minuteman III 1986 • Star 30
- Advanced Solid Axial Stage (ASAS)
- Extendible Exit Cone (EEC) 1980-1981
- High Altitude Supersonic Target (HAST) 1973
- Kinetic Energy Weapon (KEW)
- Advanced Integrated Stage (AIS) 1990
- Air Launched Space Booster 1979, 1983
- Composite Polar Boss 1990

Horizontal Test Chamber Area 1-42, A Cell



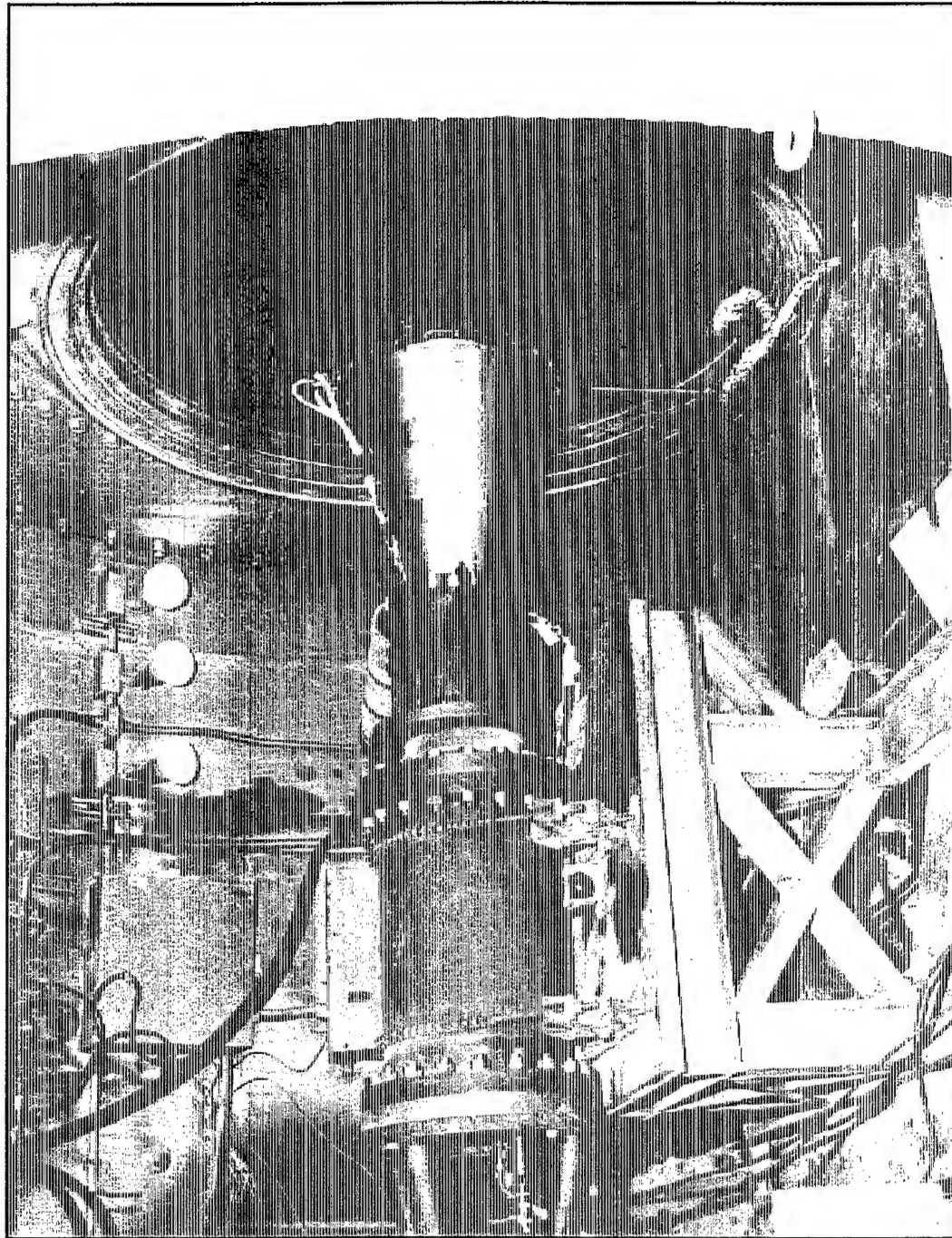
70 lb. Spin BATES

Horizontal Test Chamber Area 1-42, A Cell



Minuteman III, Stage 3, 1986

Horizontal Test Chamber Area 1-42, A Cell



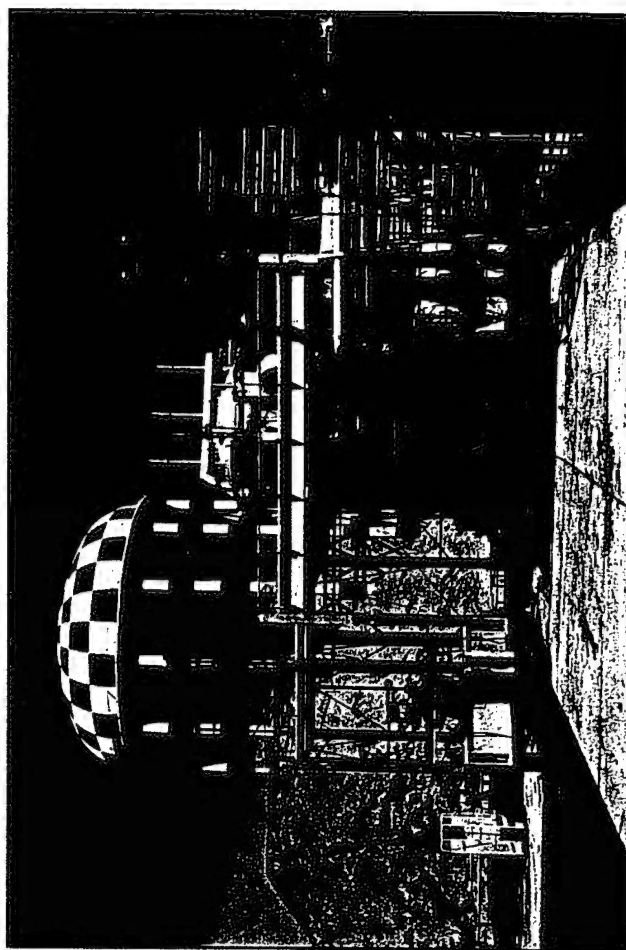
Bell Aerospace Extendible Exit Cone (EEC), 1977



Vertical Test Chamber Area 1-42, B Cell

TEST CHAMBER CAPABILITIES:

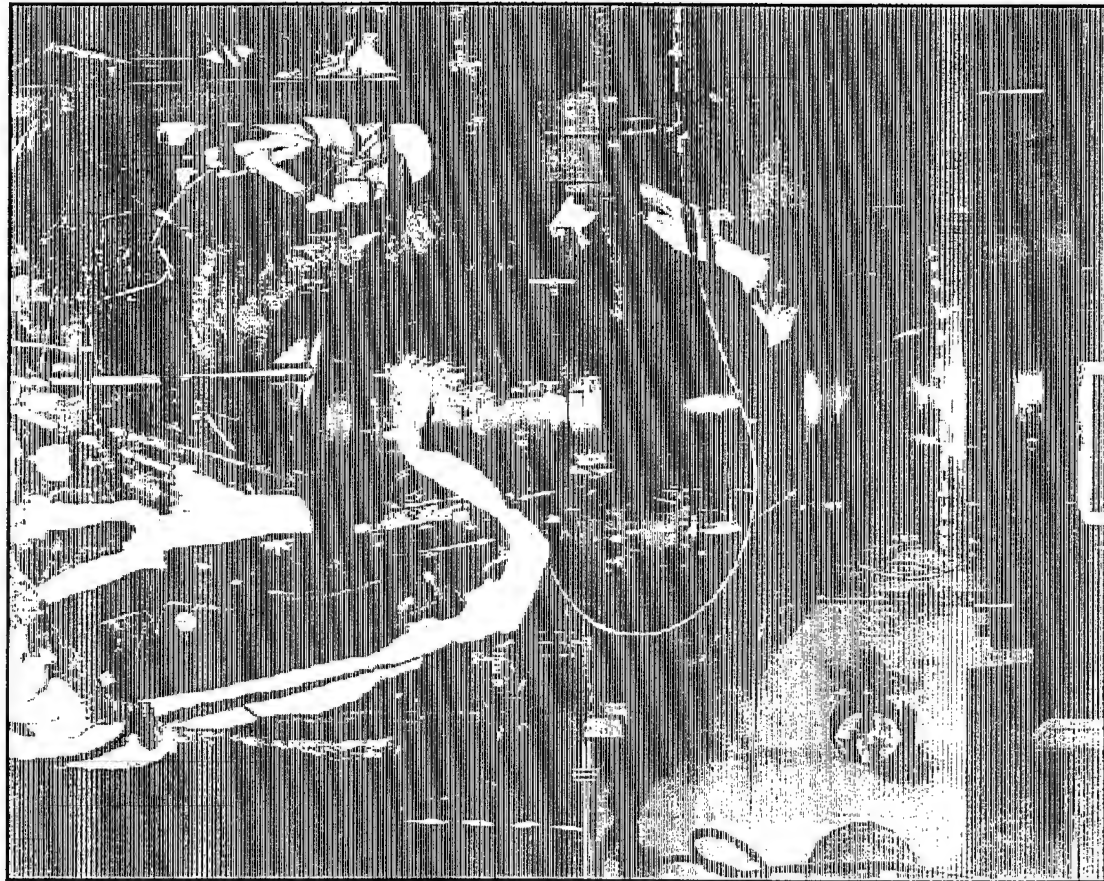
- Altitude Simulation to 125,000 Feet
- Maximum Thrust 50,000 lbf., Vertical, Nozzle Down
 - (Current Configuration) 4,500 lbf. Thrust
 - Onboard Automatic Calibration System 99.9% Accuracy
 - Motor IR Measuring Capability
 - Six Component Capability
- Chamber 16 Foot Diameter x 28 Foot High
 - Film Camera Portholes and In-Chamber Video
 - 44 Inch Diffuser
 - Solid Motors Up to 48 Inch Diameter x 15 Foot Long
- 30K of TNT Equivalent 1.1 Class Propellant



TESTING HISTORY

- StarTech 1981 • XLR 132 1983-1992
- Trident C4 1974 • Agena 1975-1976
- TRSM Navy Third Stage Rocket Motor 1997

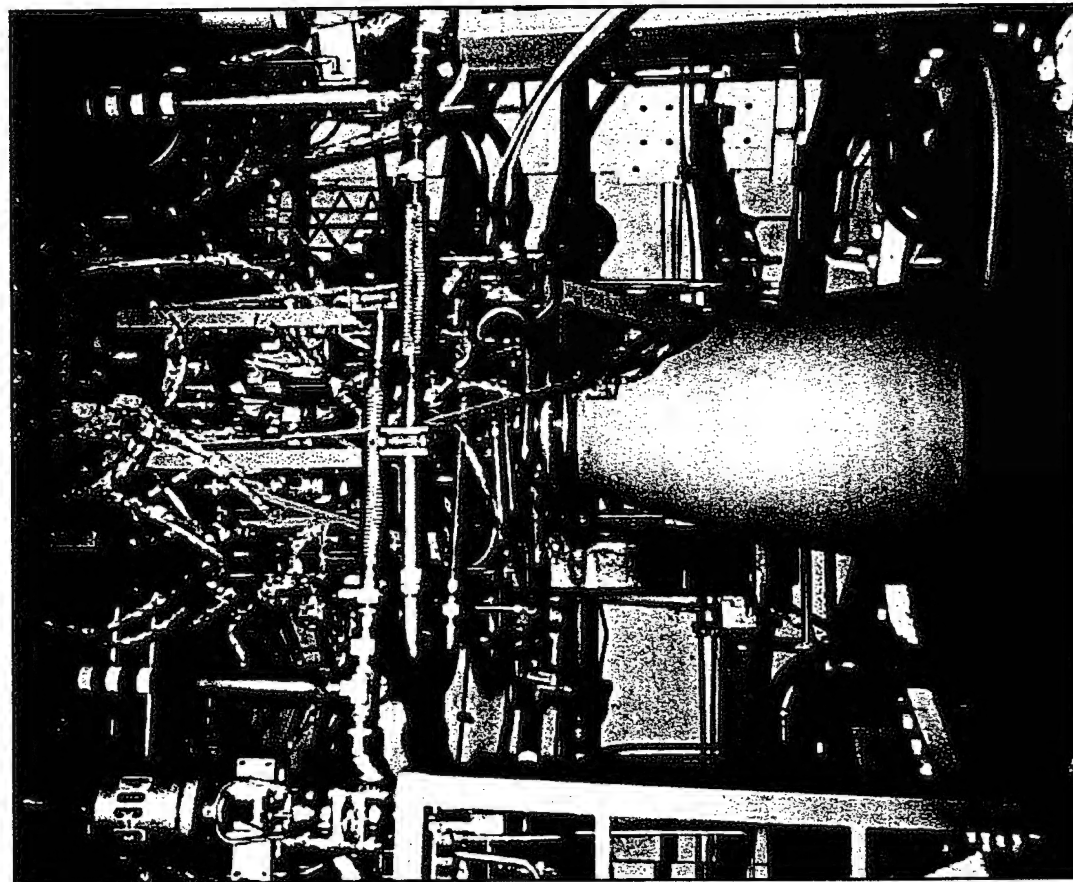
Vertical Test Chamber Area 1-42, Chamber B



Agona Engine
1975-1976

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Vertical Test Chamber Area 1-42, Chamber B

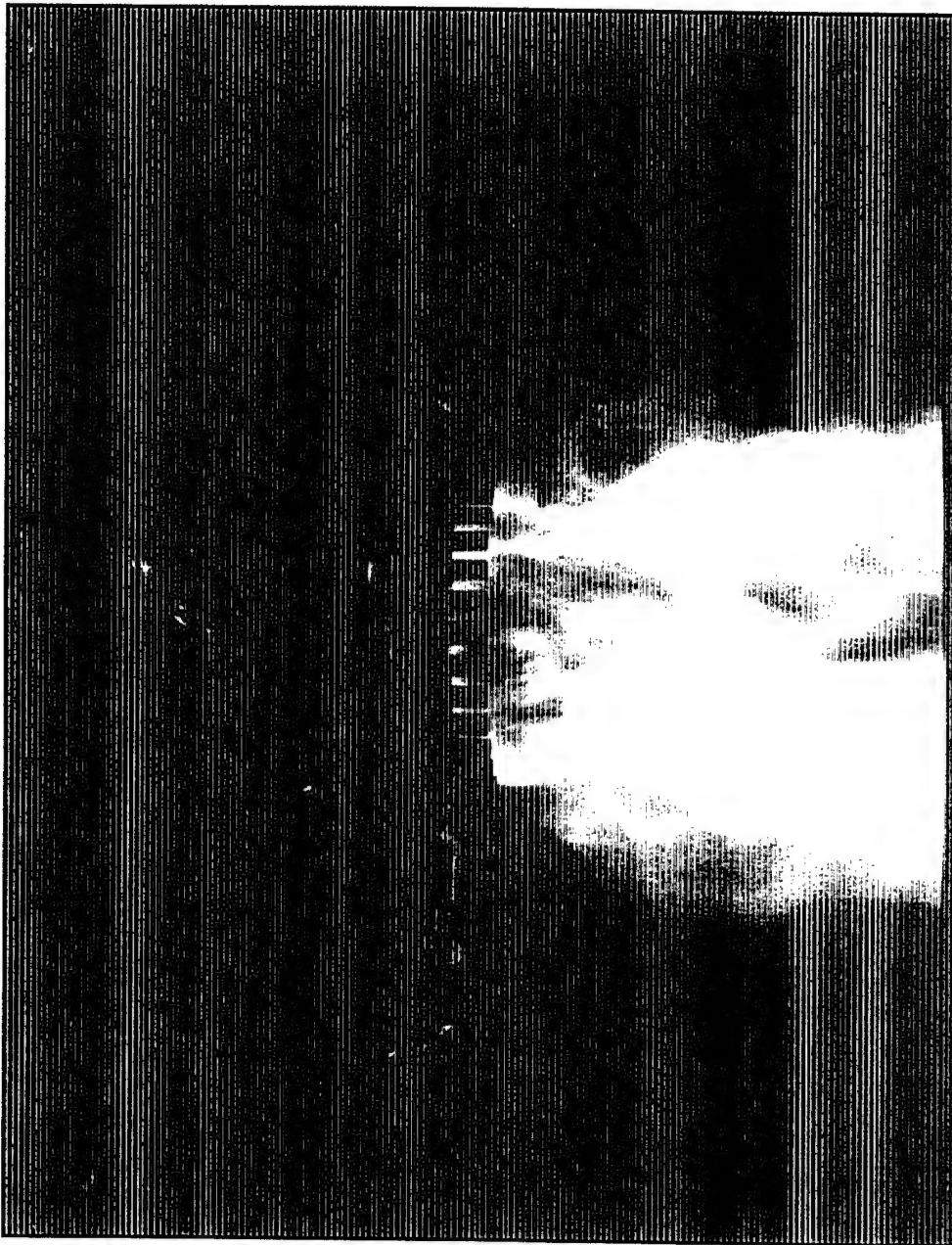


XLR-132 Engine,
1983-1992

Vertical Test Chamber Area 1-42, Chamber B



XLR-132 Engine,
1991



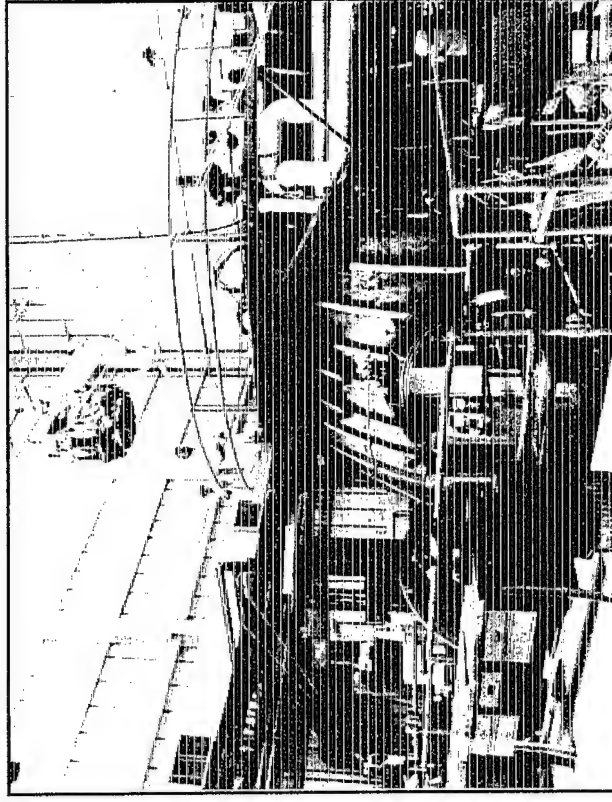


(SPEF) Test Sphere Area 1-42, C Cell

D2316B 03

TEST SPHERE CAPABILITIES:

- Mechanical Pumped Vacuum System
 - Altitude Simulation to 650,000 Feet
- SPEF Operations Building
 - Houses the Test Sphere and Control Center
 - 60 Feet x 110 Feet x 51 Feet High
 - 60 Ton and 10 Ton Traveling Overhead Cranes
- Sphere 30 Foot Diameter
 - 19 Foot Diameter Removable Top Hatch
 - 8 Foot Diameter Side Access Hinged Door
 - LN2 Cryogenic Shroud to (-190 Degree C)
 - 20 Foot Diameter x 22 Foot High (With End Caps)
 - Radiant Heat IR Simulator (200 Watts/Square Foot)
 - Earth Albedo Simulator (Maintain +/- 5 Degree C)
 - 18 Foot Diameter Aluminum Disk With 99 Heater Elements
 - Film Camera Portholes and In-Chamber Video
 - Test Article Maximums
 - 100,000 Lbs, 16 Feet x 16 Feet x 20 Feet
 - 30K of TNT Equivalent 1.1 Class Propellant
- Data Acquisition and Control
 - 150 Channel Temperature Data System
 - 256 Channel Programmable Logic Control System

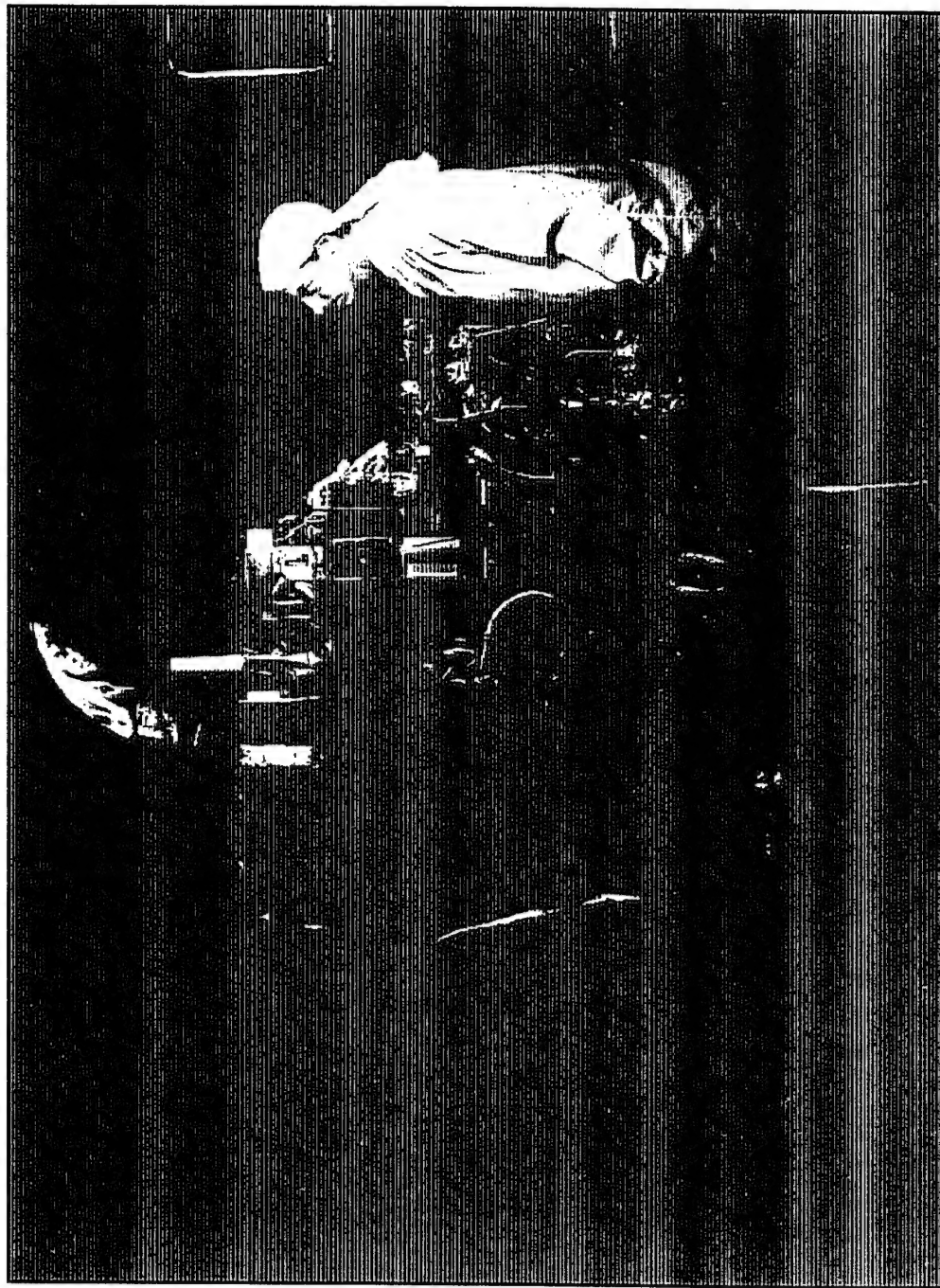


TESTING HISTORY

- Hughes TTM And STM
- Gossamer Structures
- Miniature Sensor Technology Integration (MSTI) Satellite I / II / III
- Centaur 1966
- Direct Chemical Laser (DCL) 1970-1974
- LASER Program (MESA) 1970-1974



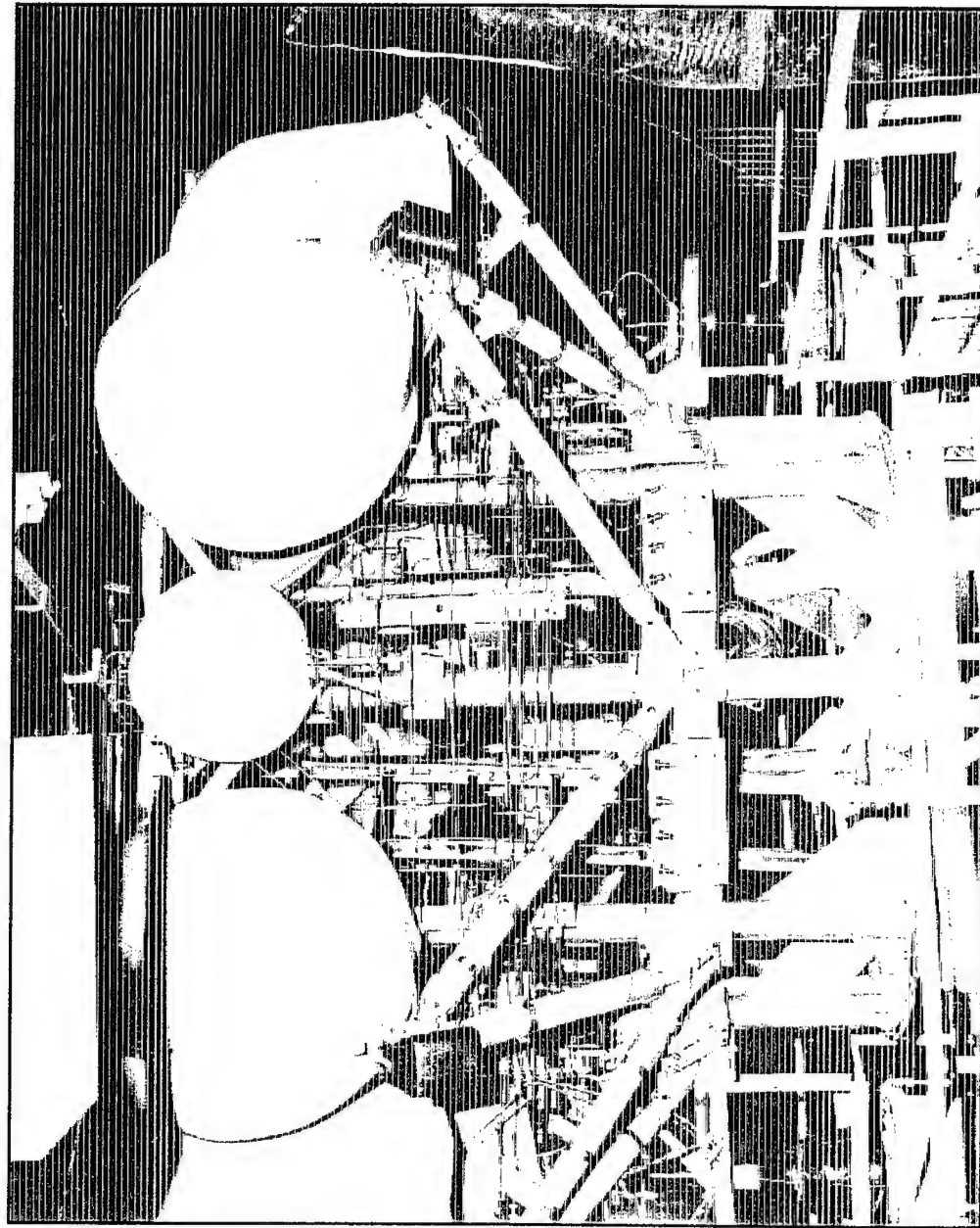
(SPEF) Test Sphere Area 1-42



MSTI II, 1995



(SPEF) Test Sphere Area 1-42, C Cell



Hughes TTM/STM 1980

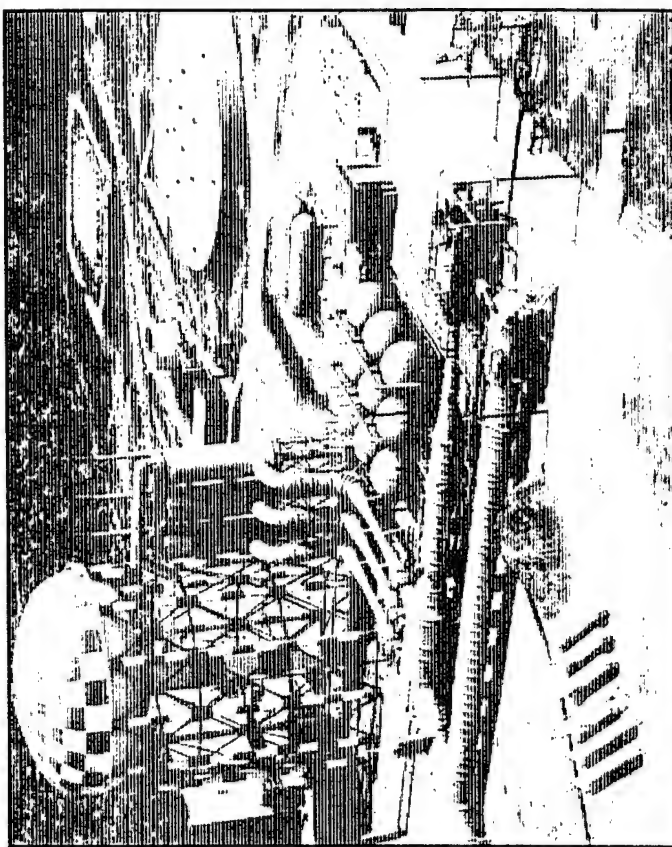


Horizontal Test Chamber

Area 1-42, D Cell

TEST CHAMBER CAPABILITIES:

- Altitude Simulation to 125,000 Feet
- Maximum Thrust 20,000 lbf., Horizontal
 - (Current Configuration) 20,000 lbf. Thrust, Horizontal
 - Onboard Automatic Calibration System 99.9% Accuracy
 - Motor Spin and IR Measuring Capability
 - Six Component Capability
- Chamber 10.5 Foot Diameter x 25 Foot Long
 - 5 Ton Overhead Crane
 - Film Camera Portholes and In-Chamber Video
 - No Diffuser (55 Inch Diffuser)
 - Solid Motors Up to 48 Inch Diameter x 18 Foot Long
- Environmental Conditioning
 - (-30 to + 120 Degrees F)
- 30K of TNT Equivalent 1.1 Class Propellant



TESTING HISTORY

- Small ICBM
- Kinetic Energy Weapon (KEW)



Large Motor Operations Complex

Area 1-52

D2316B 07

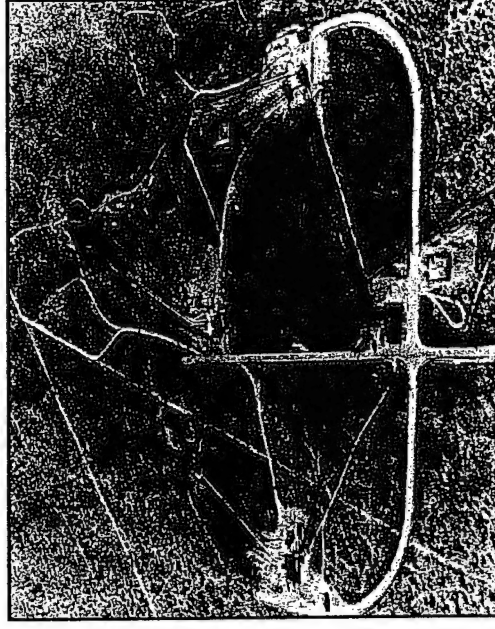
GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 8 Inch Water Main
- 440 VAC Facility and 28 VDC Stand Power
- Mechanical Shop
- 2 Assembly Buildings

TEST STAND CAPABILITIES:

(Current Configuration)

- Pad A - 50,000 lbf. Thrust
 - Horizontal or Vertical Firing
- Liquid Engines or Solid Motors
- Pad B - No Thrust Stand
 - Horizontal or Vertical Firing
 - Solid Motors
- Pad C - 5,000 Lbf. Thrust
 - Hydrostatic Bearing Test Rig
 - Horizontal Orientation
 - Liquid Hydrogen Operations
- Pad D - No Thrust Stand
 - 250 Horsepower Commercial Air Conditioning System
 - Refrigerant Operations



TESTING HISTORY

- Liquid Fluorine Engine. 1969
- Graphite Overwrap Vessel, 1990
- Minuteman III, PAN Nozzle, 1989-1991
- Short Length SuperHIPPO, (SLSH), 1977-1983
- Minuteman III, Stage 3, Advanced Nozzle, 1983-1991
- Minuteman III, Stage 2, 1983-1989
- PeaceKeeper, Stage 3, 1982
- Bull Pup, 1982
- F-16 Hydrazine Tank Test
- Titan Cook Off, 1985
- STAR TEC, 1984-1985
- Kevlar Tank Tests, 1986
- Linear Areospace SR-71 Experiment LASRE, 1996
- Turbopump Component Technologies 1989-1996
- R134a Carrier Dual Use Technologies 1996-1997



Large Motor Operations Complex

Area 1-52

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 8 Inch Water Main
- 440 VAC Facility and 28 VDC Stand Power
- 192 Channel Data Acquisition and 256 Channel Control System
- Mechanical Shop
- 2 Assembly Buildings

TEST STAND CAPABILITIES:

- Ground Level Testing
- Environmental Conditioning
- Pad A - Maximum Thrust 1,000,000 lbf.
 - (Current Configuration) 50,000 lbf. Thrust
 - Horizontal or Vertical Firing
 - Assembly Building
 - 77,000 lbs of TNT Equivalent Propellant
- Pad B - Maximum Thrust 1,000,000 lbf.
 - (Current Configuration) No Thrust Stand
 - Horizontal or Vertical Firing
 - 77,000 lbs of TNT Equivalent Propellant

TEST STAND CAPABILITIES (Cont):

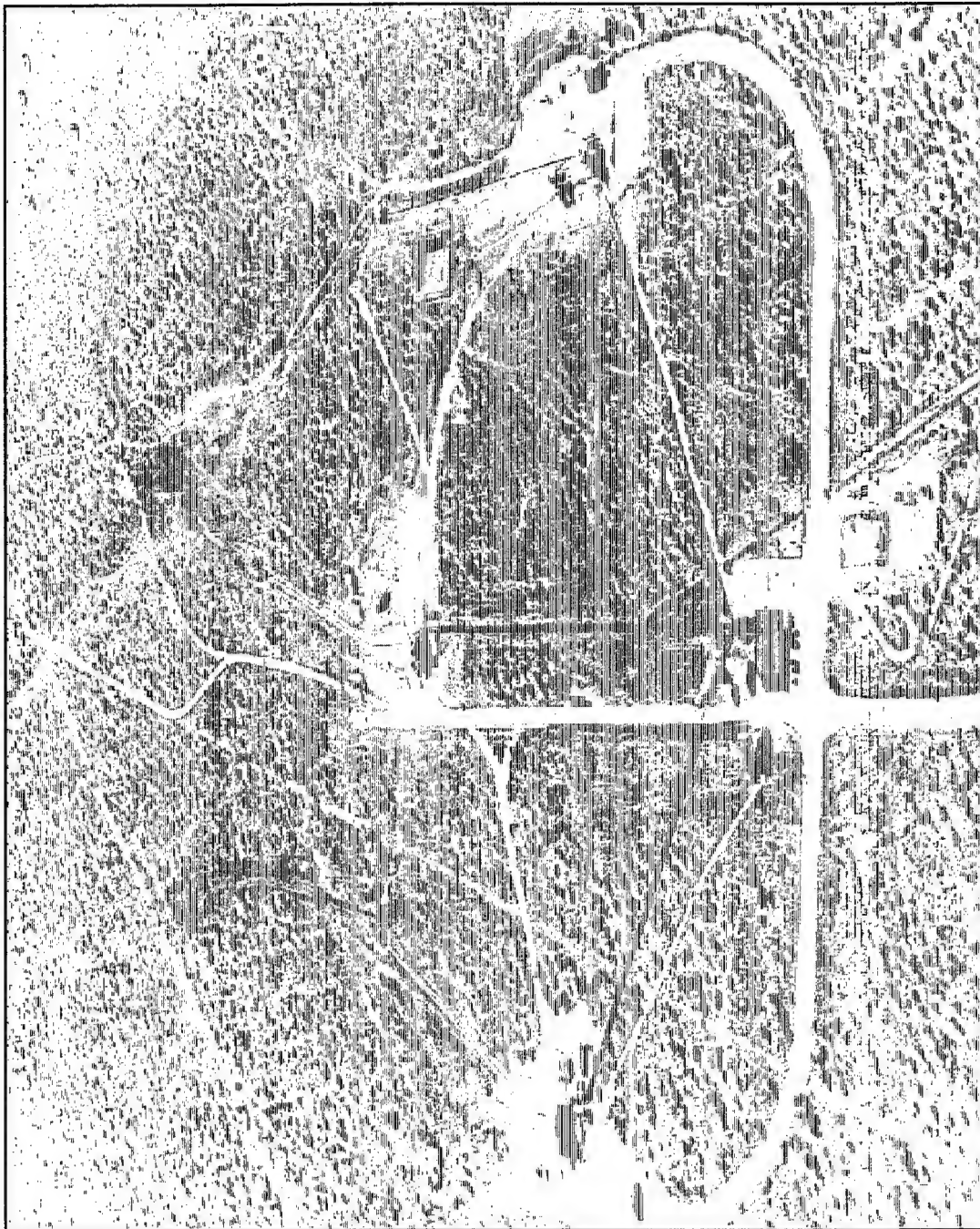
- Pad C - Maximum Thrust 1,000,000 Lbf.
 - (Current Configuration) 5,000 lbs. Thrust
 - Horizontal Orientation
 - Hydrostatic Bearing Test Rig
 - 70,000 lbs of TNT Equivalent Propellant
- Pad D - Maximum Thrust 1,000,000 lbf.
 - (Current Configuration) No Thrust Stand
 - 250 Horsepower Commercial Air Conditioning System
 - 70,000 lbs of TNT Equivalent Propellant
 - C/D Stand Assembly Building

TESTING HISTORY

- Liquid Flourine Engine. 1969
- Minuteman III, Pan Nozzle, 1989-1991
- Short Length SuperHIPPO, (SLSH), 1977-1983
- Minuteman III, Stage 3, Advanced Nozzle, 1983-1991
- Minuteman III, Stage 2, 1983-1989
- Graphite Overwrap Vessel, 1990
- PeaceKeeper, Stage 3, 1982 • Titan Cook Off, 1985
- STAR TEC, 1984-1985 • Bull Pup, 1982
- F-16 Hydrazine Tank Test • Kevlar Tank Tests, 1986
- Linear Areospace SR-71 Experiment LASRE, 1996
- Turbopump Component Technologies 1989-1996
- R134a Carrier Dual Use Technology 1996-1997

Large Motor Operations Complex

Area 1-52



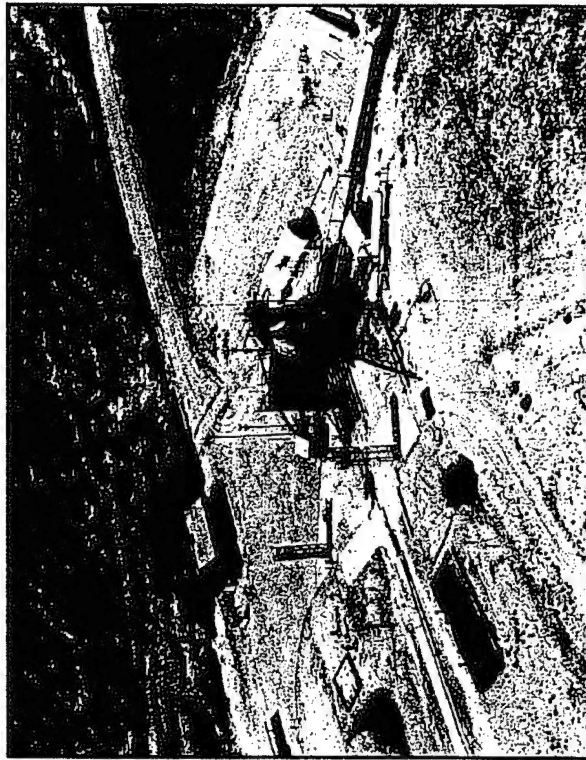


Rocket Motor Test Stand

Area 1-52, Test Stand A

TEST STAND A CAPABILITIES:

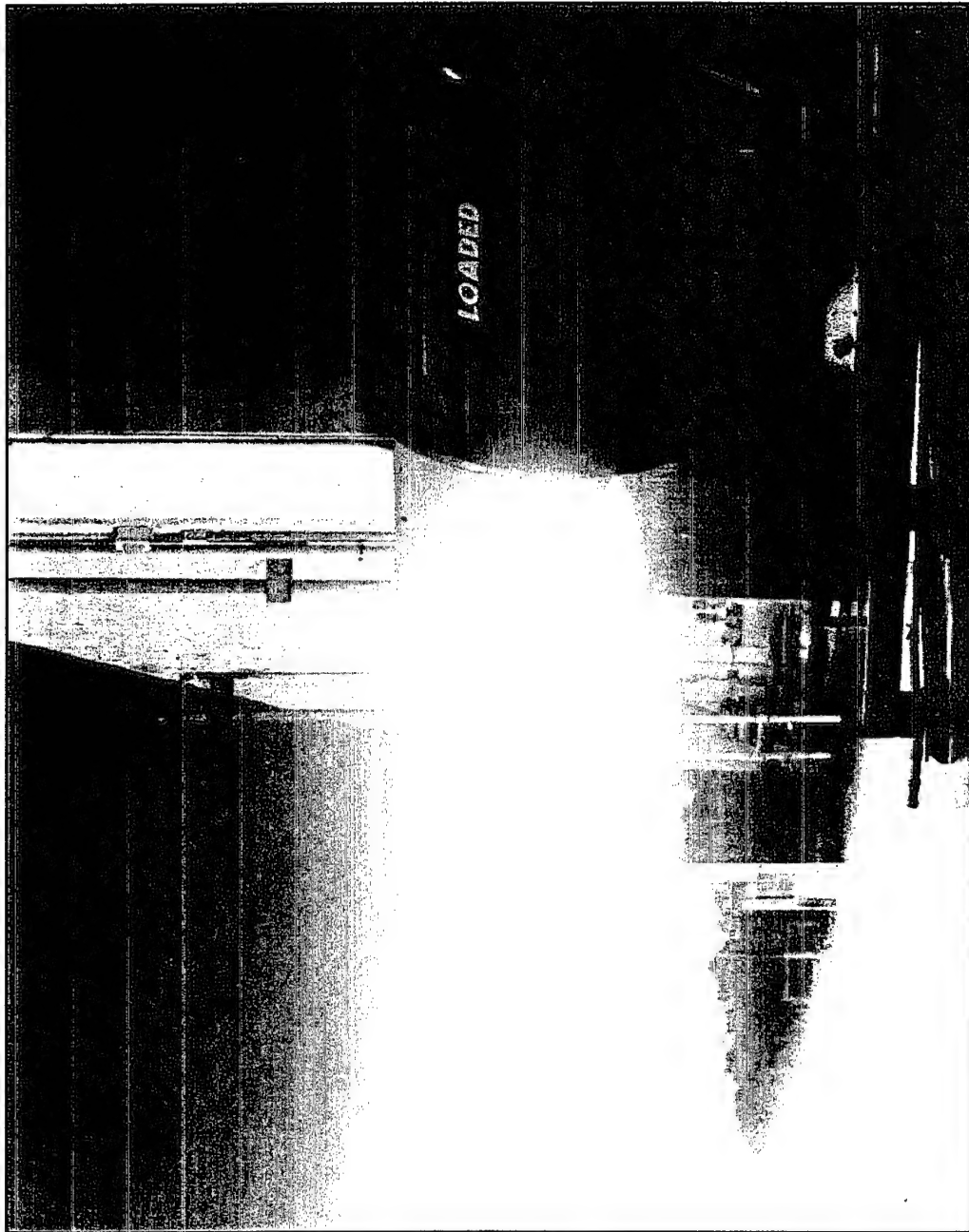
- Ground Level Testing
- Storable, Cryogenic, and Solid Propellant
- 30' x 45' x 5' Concrete Pad
- Horizontal or Vertical Firing
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
 - 50,000 lbf. Thrust Stand
 - Horizontal, Single Axis
- 77,000 lbs of TNT Equivalent Propellant



TESTING HISTORY

- Liquid Fluorine Engine. 1969
- Minuteman III, PAN Nozzle, 1989-1991
- Short Length SuperHIPPO, (SLSH), 1977-1983
- Zirconium Replacement Studies, 1983-1985
- Minuteman III, Stage 2, 1983-1989
- Small ICBM (SICBM) 1989 • F-16 Hydrazine Tank Test
- Motor Influence 1977 • Joint Live Fire 1986
- Linear Areospace SR-71 Experiment LASRE, 1996

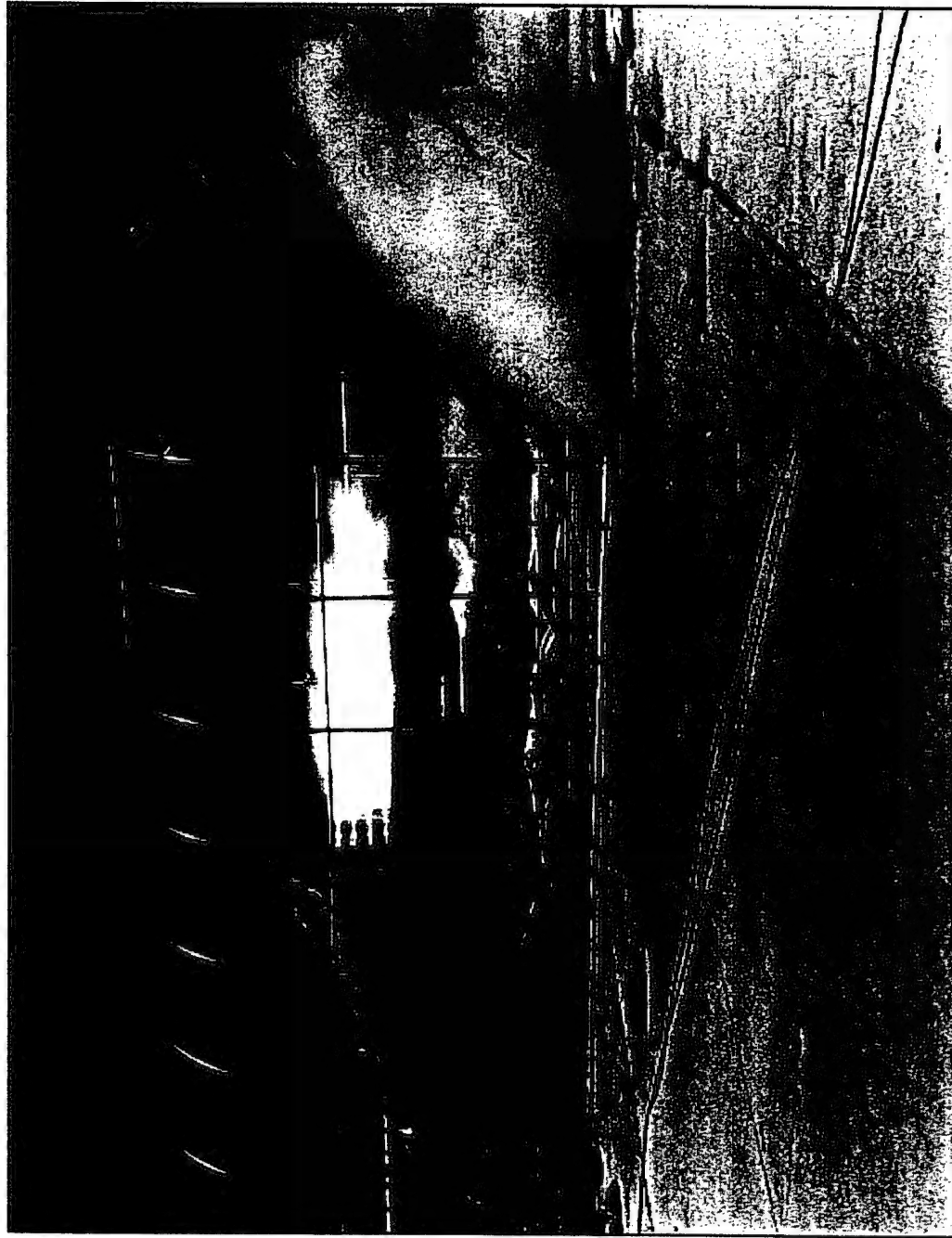
Large Motor Operations Complex, Pad A



Minuteman III, Stage 3, 1985



Large Motor Operations Complex, Pad A



Linear Aerospike SR-71 Engine, 1997

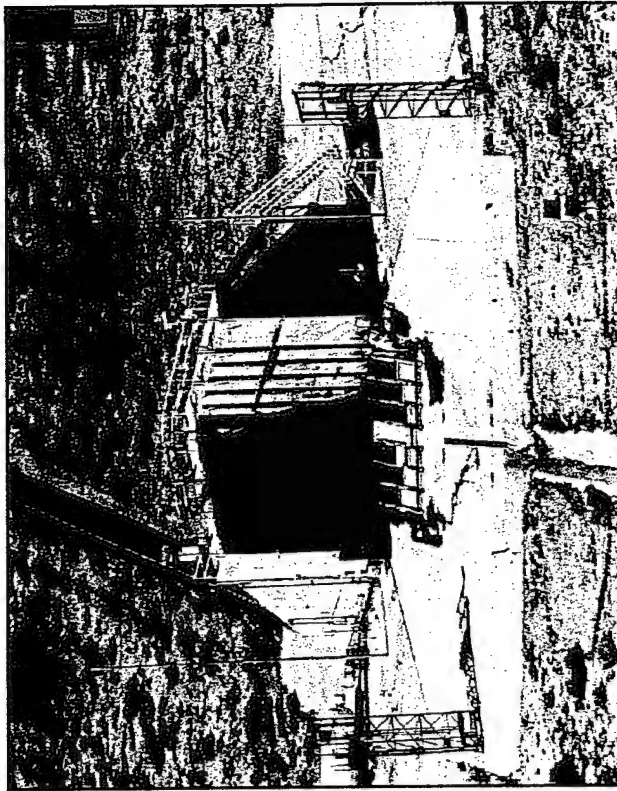


Large Motor Test Stand

Area 1-52, Test Stand B

TEST STAND B CAPABILITIES:

- Ground Level Testing
- Storable and Solid Propellant
- 30' x 45' x 5' Concrete Pad
- Horizontal or Vertical Firing
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
 - No Thrust Stand
- 77,000 lbs of TNT Equivalent Propellant



TESTING HISTORY

- Special High Performance Ignition Technology (SHIPIT). 1983
- Minuteman III, Stage 3, Advanced Nozzle, 1983-1991
- Minuteman III, Stage 2, 1983-1989
- PeaceKeeper Design Margin, 1988
- PeaceKeeper, Stage 3, 1982
- CHAR Motor 1980
 - Bull Pup, 1982
- Titan Cook Off, 1985
 - 84 Inch CHAR Motor, 1980-1981

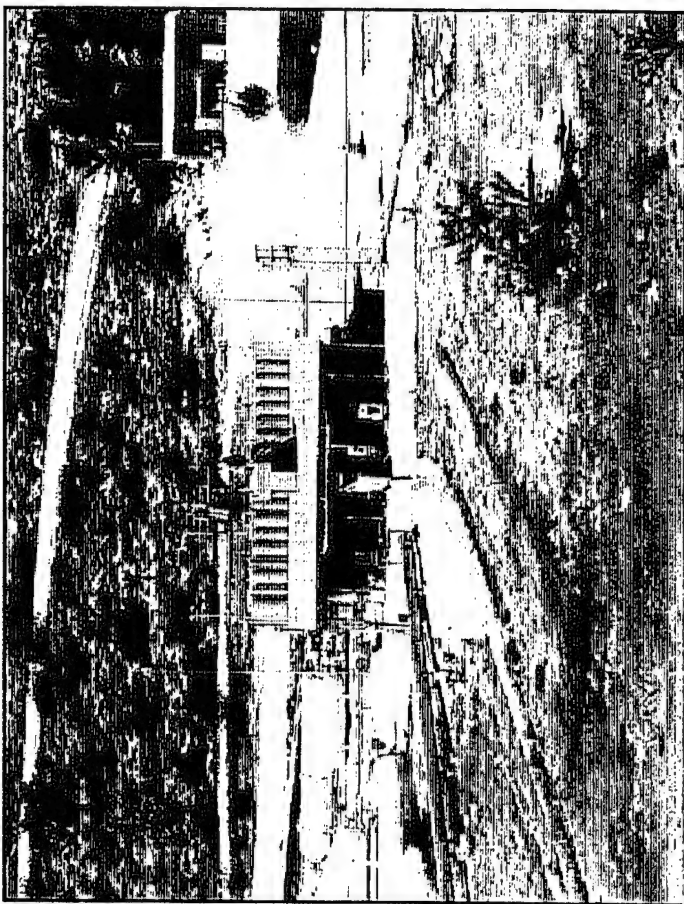


Large Motor Test Stand

Area 1-52, Test Stand C

TEST STAND C CAPABILITIES:

- Modified for High Pressure Cryogenic or Steel Bearing Material Testing
- Ground Level Testing
- Storable, Cryogenic, and Solid Propellant
- 28' x 30' x 5' Concrete Pad
- Horizontal Orientation
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
 - 5,000 Lbf Thrust Stand
 - Hydrostatic Bearing Test Rig
- 77,000 lbs of TNT Equivalent Propellant
- Hydrogen Burn Stack; 16 Lb/Mass Per Second



TESTING HISTORY

- Nose Tip Testing, 1972-1980
- Graphite Overwrap Vessel, 1990
- STAR TEC, 1984-1985
- Turbo Pump Component Technologies 1989-1996
- R134a Carrier Dual Use Technologies 1996-1997



Large Motor Operations Complex, Pad C



ABRES Nosetip Chamber Assembly, 1972 - 1980

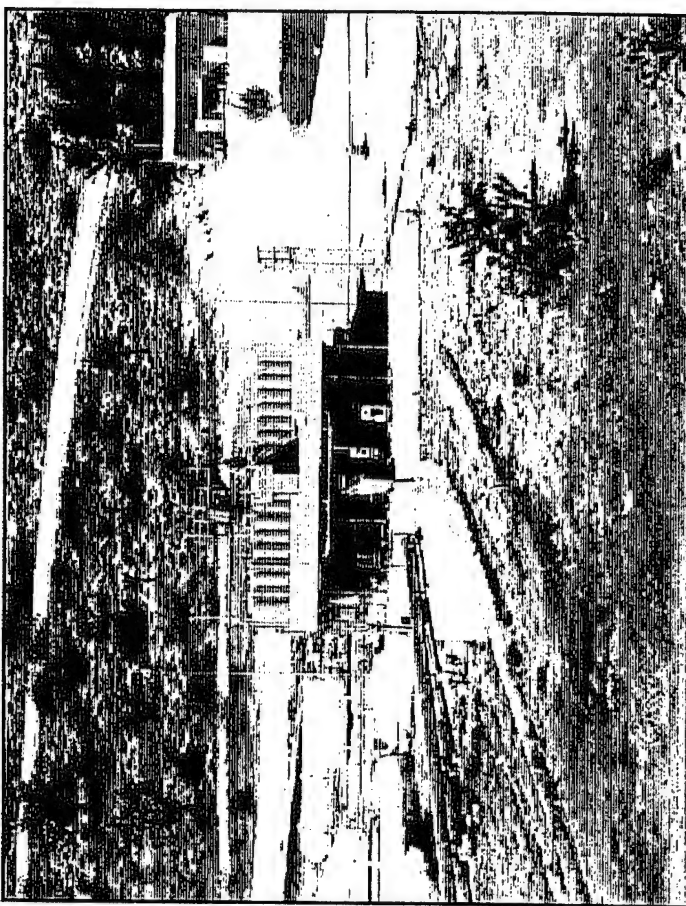


Large Motor Test Stand

Area 1-52, Test Stand D

TEST STAND D CAPABILITIES:

- Modified for High Pressure Commercial Air Conditioning Testing
- Ground Level Testing
- Storable, Cryogenic, and Solid Propellant
- 28' x 30' x 5' Concrete Pad
- Horizontal Orientation
- Maximum Thrust 1,000,000 lbf.
- (Current Configuration)
 - No Thrust Stand
- 77,000 lbs of TNT Equivalent Propellant



TESTING HISTORY

- Kevlar Tank Tests, 1986
- Carrier Air Conditioner (ARPA), 1996



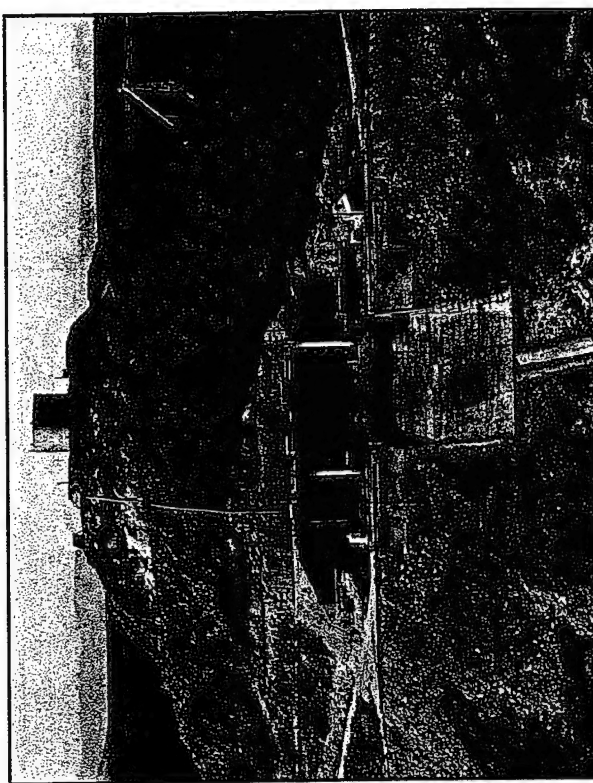
High Thrust Facility Area 1-56

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line, 6,000 psi
- 6 Inch Water Main
- 1 Million Gallon Deluge Water Storage
- 440 VAC and 28 VDC Stand Power
- SHOPS:
 - Control Sta., 5,000 Sq. Ft.
 - Mechanical, 2 ea., 5,000 Sq. Ft.
- Currently Configured for LOX Hybrid Rocket Testing
- TEST RESTRICTIONS: 3 to 7 Knots Wind Corridor

TEST STAND CAPABILITIES:

- Ground Level Testing
- Cryogenic; Storable; Solid
- Maximum Thrust, 10,000,000 lbs
 - Current Configuration
 - 450,000 lbf Thrust, Vertical, Nozzle Up, Six-component
 - 400,000 lbf Thrust, Horizontal, Six-Component
 - Maximum Downward Displacement 15 Degrees
- 2,500,000 lbs Class 1, TNT Equivalent
- GN2 Vessels, 4 ea., 270 cu. ft., 6,600 psi
- Run Vessels, 2 ea, 9,000 and 12,000 gal.

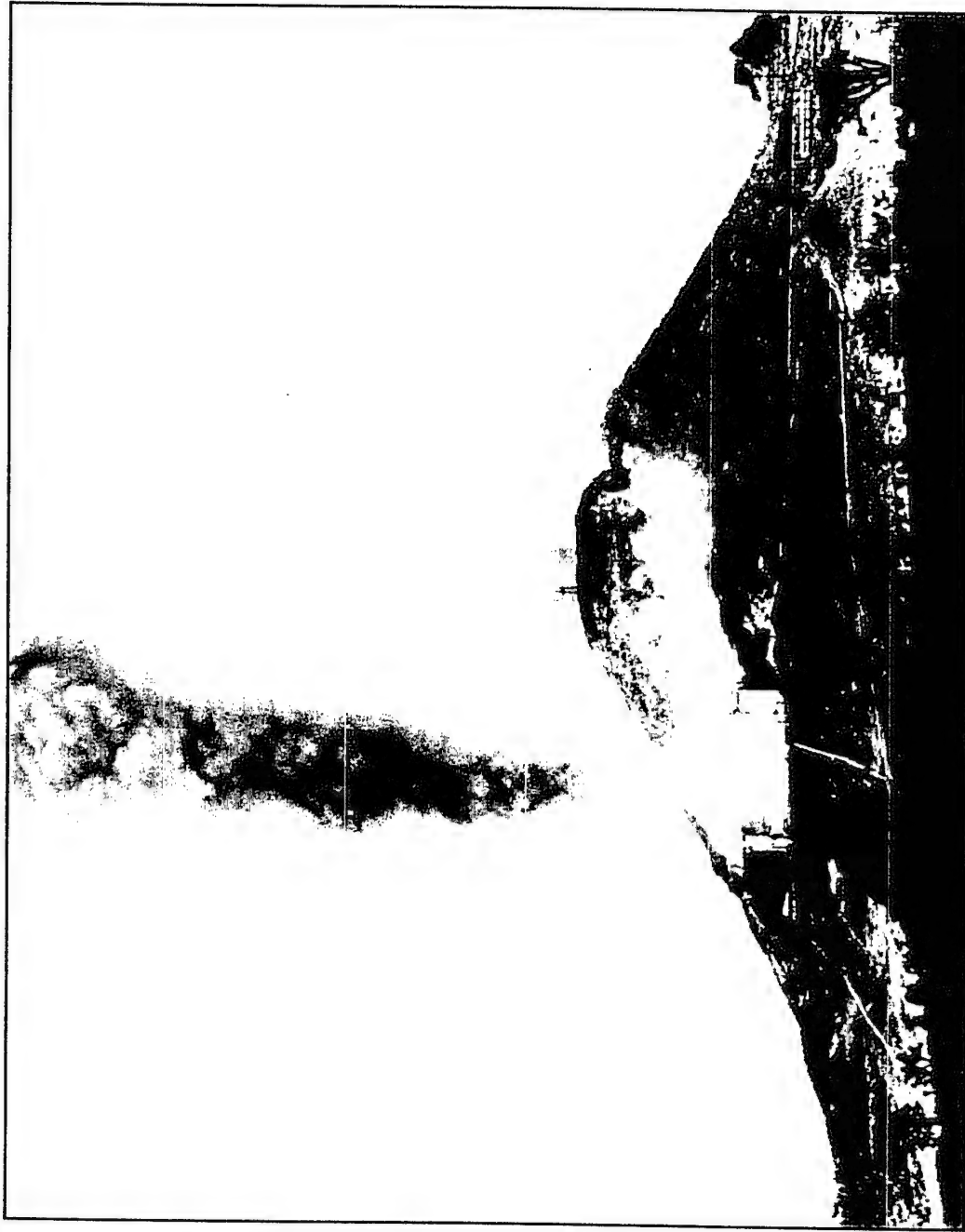


TESTING HISTORY

- Extended Length SuperHIPPO (ELSH)
- Big Dumb Booster (Low Cost, High Thrust, Space Shuttle Alternative)
- AMROC Hybrid 1995
- Railroad Tank Car (Propane Relief Valve)
- X-33 Launch Facility 1997



High Thrust Facility



Extended Length Super HIPPO, 1985



Satellite Test & Integration Facilities

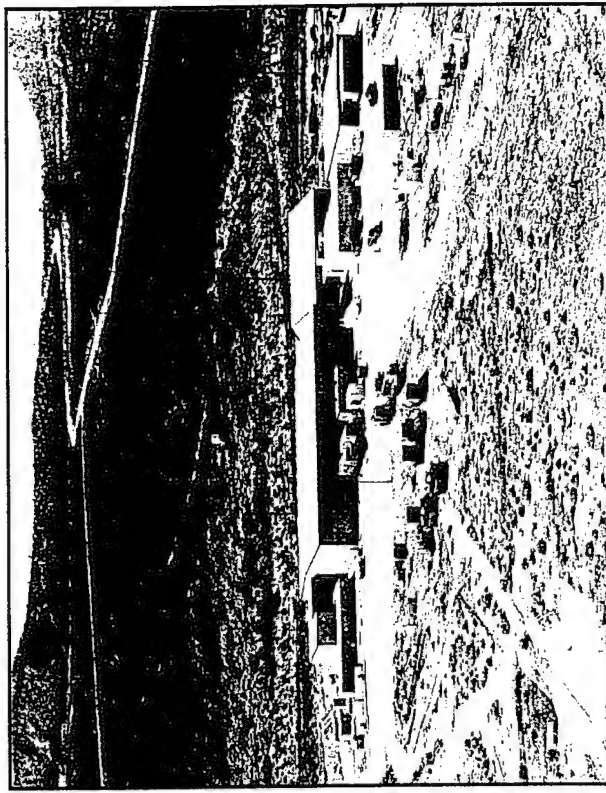
Area 1-90

DESIGNED CAPABILITY:

- Designed to Hold Three Small Satellites Simultaneously
- 10,000 Parts Per Million Clean Room Capability
- Controlled Temperature 70 to 78 Degrees
- Relative Humidity Control
 - 30 to 50 Percent
- Static Discharge Protection
- Sealed Corridors Between Buildings
- One-Ton Capacity Overhead Crane With Load Attenuating Devices
- 34,900 Square Feet of Test Area
 - Altitude Simulations
 - Vibration Table
 - Telemetry Ground Station

CURRENT CAPABILITY:

- Facility Inactive
- Equipment Removed



TESTING HISTORY:

- Miniature Sensor Technology Integration (MSTI) - MSTI 1, MSTI 2 & MSTI 3
- Advanced Concept Architecture Test (ACAT) - ACAT Vehicle
- Summer Undergraduate Research Fellowship Satellite (SURF SAT)



Blast Hazard Complex

Area 1-90, Test Pad 1-90

FACILITIES CAPABILITIES:

- Blast Hazard Capability
Converted to Satellite Test and
Integration Complexes

TEST STAND CAPABILITIES:

- Historic
 - Ground Level Testing
 - Liquid Propellant
 - Bare Pad
 - 150,000 Lbs TNT Equivalent



TESTING HISTORY:

- Titan I, 1st Stage
- Saturn S4B
- Blast Hazard Studies for Apollo Program



Blast Hazard Complex Area 1-90, Test Pad 1-95

FACILITIES CAPABILITIES:

- Blast Hazard Capability
Converted to Satellite Test and
Integration Complexes

TEST STAND CAPABILITIES:

HISTORIC:

- Atlas First Loading of LOX and
RP-1 Propellants



TESTING HISTORY:

- Atlas Propellant Loading



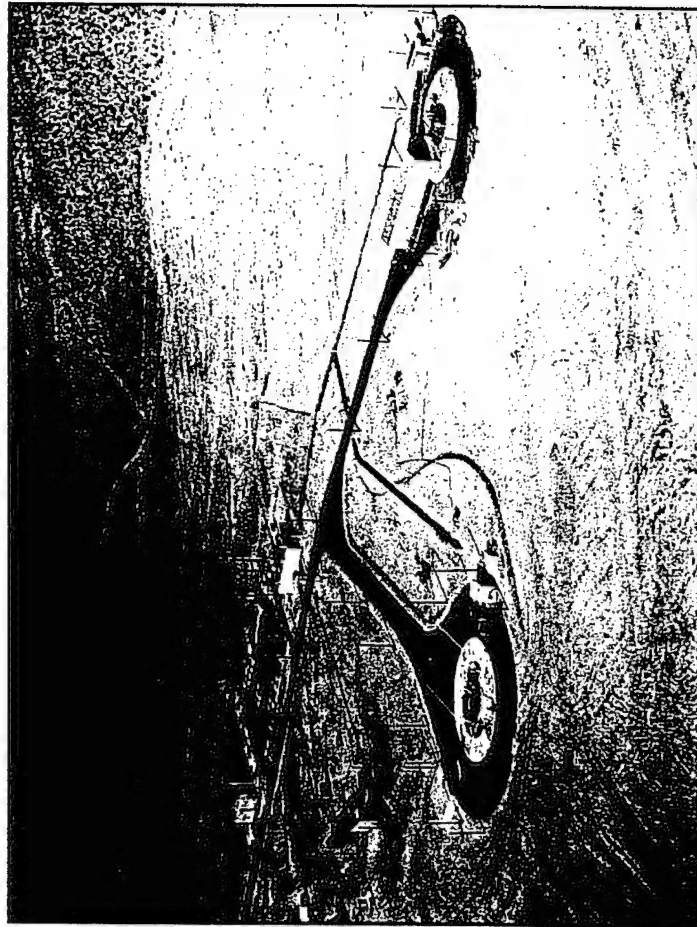
Silo Complex Area 1-100

FACILITIES CAPABILITIES:

- Facility Inactive
- GN2, Power Available
- Mechanical Shop

TEST STAND CAPABILITIES:

- Two Silos, 26 Feet in Diameter
 - 86 Feet Deep
- Silos are Inactive



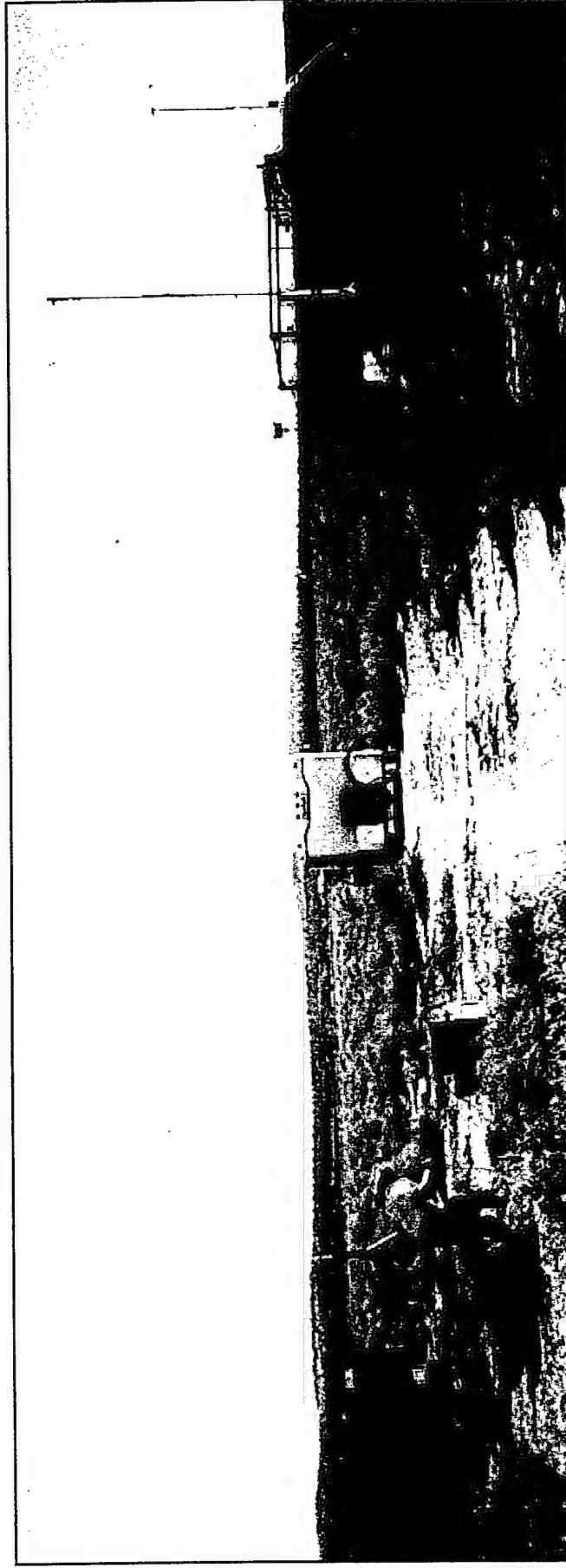
TESTING HISTORY:

- Minuteman Tethered Launch
- PeaceKeeper Tethered Launch
- Leonid Storm 1997



Silo Complex Area 1-100

D2318B 023



LEONID STORM METEORITE
SHOWER, NOV 1997



Large Engine Component/System Test Complex

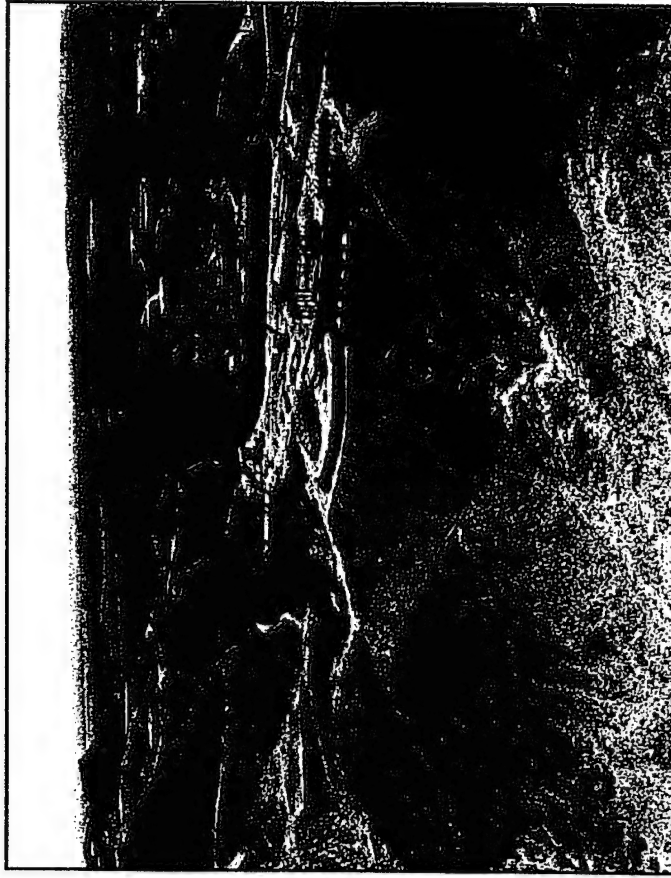
Area 1-120

GENERAL AREA CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
 - Can be Pumped up to 10,000 psi
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3,000 psi Stand Hydraulics
- Ground Level Mechanical Shop
 - With 5 to 10 Ton Traveling Overhead Cranes
- Additional Mechanical Shops Beneath Test Stand
 - Small Fabrication / Repair
- Data Acquisition and Control System
 - 320 Channel, 100,000 Sample Per Second

TEST STAND CAPABILITIES: (CURRENT CONFIGURATION)

- Ground Level Testing
- Test Stand 2 - A, 1.5M lbf Thrust, 15 Degree Down
 - GN2 Run/Storage; 6,000 psi, 5010 Cubic Feet
 - LO2 Run Tank; 8,500 psi, 2,000 Gallon
 - LH2 Run Tank; 6,000 psi, 3,800 Gallon
- Test Stand 1 - A, 1.6M lbf Thrust, Nozzle Down
 - GN2 Run/Storage; 4,500 psi, 2850 Cubic Feet
 - LO2 Run Tank; 165 psi, 75,000 Gallon
 - LH2 Run Tank; 165 psi, 90,000 Gallon
- Test Stand 1 - B, Inactive, Nozzle Down



TESTING HISTORY

- F-1 Thrust Chamber (5,000 Firings)
- F-1 Moon Rocket Tests
- Atlas (System) Tests
- F-1 Engines
- RS-68 EELV 1998



Large Engine Component/System Test Complex Area 1-120





Large Engine System Test Stand, Area 1-120, Test Stand 1-A

FACILITIES CAPABILITIES:

- 4,500 psi GN2 Line, 2850 Cubic Feet Storage
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3,000 psi Stand Hydraulics
- Access to the 2A Mechanical Shop
 - With 10 Ton Traveling Overhead Cranes
- 800,000 Gallon Deluge Storage
 - 1,000,000 Gallon Catch Basin
- Data Acquisition and Control System
 - 320 Channel, 100,000 Sample Per Second
 - High Speed FM and Oscillograph Recording

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 4,000,000 lbf, Nozzle Down
 - (Current Configuration) Thrust Stand
 - 1,600,000 lbf Axial Thrust
- LO2 Cryo Run System; 75,000 Gallon, 165 psi
- Fuel Run System; LH2/RP-1, 90,000 Gallon, 165 psi
- 20,000 lb TNT Equivalent of 1.1 Propellant



TESTING HISTORY

- Atlas (System) Tests
- F-1 Moon Rocket Tests (750 Firings)
- RS-68 EELV 1998



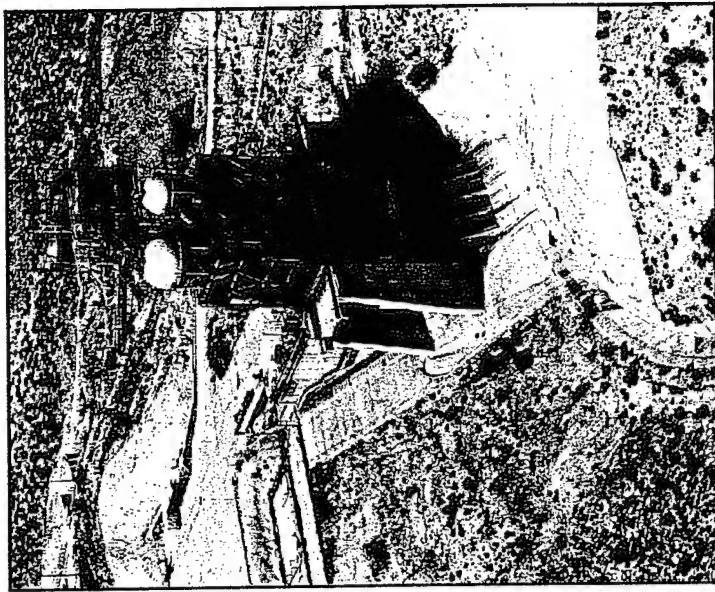
Large Engine System Test Stand, Area 1-120, Test Stand 1-B

FACILITIES CAPABILITIES:

- 4,500 psi GN2 Line, 2850 Cubic Feet Storage
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Mechanical Shop
- Additional Mechanical Shop Beneath Test Stand
- 800,000 Gallon Deluge Storage
 - 3,000,000 Gallon Catch Basin
- Data Acquisition and Control System(Proposed)
 - 320 Channel, 100,000 Sample Per Second
 - High Speed FM and Oscillograph Recording
 - 256 Channel Programmable Logic Control

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 6,000,000 lbf, Nozzle Down
 - (Current Configuration) Inactive, No Thrust Stand
- 100,000 lb TNT Equivalent of 1.1 Propellant
- 10 Ton Traveling First Story Crane
- 5 Ton Jib Crane on Top of Stand



TESTING HISTORY

- F-1 Engines (980 Tests)



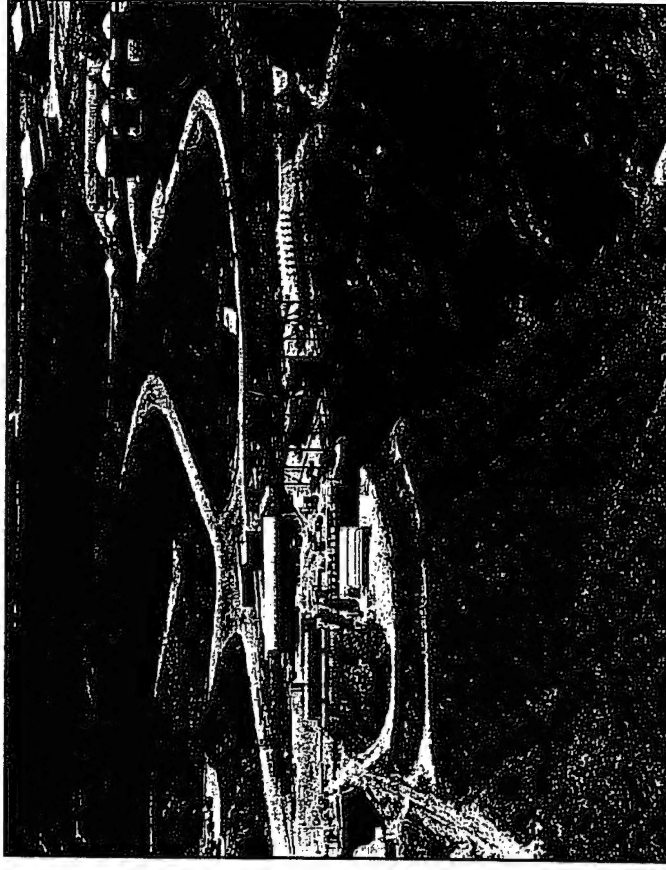
Large Engine Component Test Stand, Area 1-120, Test Stand 2-A

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3,000 psi Stand Hydraulics
- Mechanical Shop
 - With 5 Ton Traveling Overhead Crane
- Data Acquisition and Control System
 - 320 Channel, 100,000 Sample Per Second
 - High Speed FM and Oscillograph Recording
 - 256 Channel Programmable Logic Control

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 2,000,000 lbf, 15 Degree Down
 - (Current Configuration) Thrust Stand
 - 1,500,000 lbf Axial Thrust
- 20,400 lb TNT Equivalent of 1.1 Propellant
- GN2 Storage; 10,000 psi, 940 Cubic Feet
- GN2 Storage; 6,000 psi, 5010 Cubic Feet
- GH2 Storage; 10,000 psi, 1600 Cubic Feet
- GH2 Storage; 6,000 psi, 2350 Cubic Feet
- GHe Storage; 6,000 psi, 400 Cubic Feet
- LH2 Storage; 100 psi, 28,000 Gallon
- LO2 Storage; 30 psi, 26,000 Gallon
- LO2 Run Tank; 8,500 psi, 2,000 Gallon
- LH2 Run Tank; 6,000 psi, 3,800 Gallon
- RP-1 Run / Storage 6,000 psi, TBD Gallon



TESTING HISTORY

- F-1 Thrust Chamber (5,000 Firings)



Large Systems Complex Area 1-125

D23188 029

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 3 Mechanical Shops
 - With 25 Ton Traveling Overhead Cranes
 - With Environmental Conditioning

TEST STAND CAPABILITIES: (Current Configuration)

- Ground Level Testing
- Test Stand 1 - C 1.6M Lbf Thrust, Nozzle Down
- Test Stand 1 - D Inactive, Nozzle Down
- Test Stand 1 - E Inactive, Nozzle Down
 - Modified for Hover Testing Requirements



TESTING HISTORY

- Titan 34D
- Saturn V
- SRM Booster
- Kinetic Kill Vehicle (KKV Prototype and Advanced)
- Titan IV
- H1 Engine
- SRMU Booster



Large Systems Complex

Area 1-125

GENERAL AREA CAPABILITIES:

- Commissioned in the Early 1960'S
- Integral Testing for Most Major United States Booster Systems
- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- 3 Mechanical Shops (High Bay Assembly Buildings)
 - 94 Wide X 115 Tall X 50 High
 - With 25 Ton Traveling Overhead Cranes
 - With Environmental Conditioning
- Two Story, Central Operations Center
 - NEFF 620, 512 Channel, 50,000 Sample Per Second Data Acquisition System
 - Programmable Logic Control System

TEST STAND CAPABILITIES:

- Ground Level Testing
- Test Stand 1C Supported Rocketdyne F-1 Engine Tests Through 1974
 - Maximum Thrust 6M lbf.
 - Test Stand Idle Since 1974, Re-activated 1986
 - Current Configuration
 - For TITAN IV Support
 - 1.6M lbf, Six-component Thrust Stand
 - Vertical, Nozzle Down
 - Other Programs; TITAN 34D, SRM and SRMU Boosters
- Test Stand 1D Supported Rocketdyne F-1 Engine Tests Through 1974
 - Maximum Thrust 6M lbf., Vertical, Nozzle Down
 - Test Stand Idle Since 1974
- Test Stand 1E Supported Rocketdyne H-1 Engine Tests Through 1975
 - Test Stand Idle Since 1975
 - Modified for Hover Testing Requirements
 - Added Adjacent Target Test Stand
 - Vehicle Integration Facility, With a Clean Room
 - Propellant Storage and Handling
 - Range Support for Fueling and Handling KKV's
 - Supported KKV (Prototype and Advanced)

Large Systems Complex Area 1-125





Titan SRM Test Facility

Area 1-125, Test Stand 1-C

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Mechanical Shop
 - With 25 Ton Traveling Overhead Crane
 - With Environmental Conditioning
- 3,400,000 Gallon Deluge Storage
 - Cooling Water can be Pumped at 168,000 gpm
 - 800,000 Gallon Catch Basin
- Modified 1988 for Titan 34D
 - Current Configuration for Titan IV

TEST STAND CAPABILITIES:

- Ground Level Testing
- Multi-story Environmental Conditioning
 - 25 to 100 Degrees F, 40 Percent Relative Humidity
- Maximum Thrust 6,000,000 lbf., Nozzle Down
 - (Current Configuration) 6 Component Thrust Stand
 - 2,500,000 lbf. Thrust Takeout
 - 1,600,000 lbf. Axial Thrust
- 690,000 lb of 1.3 Propellant

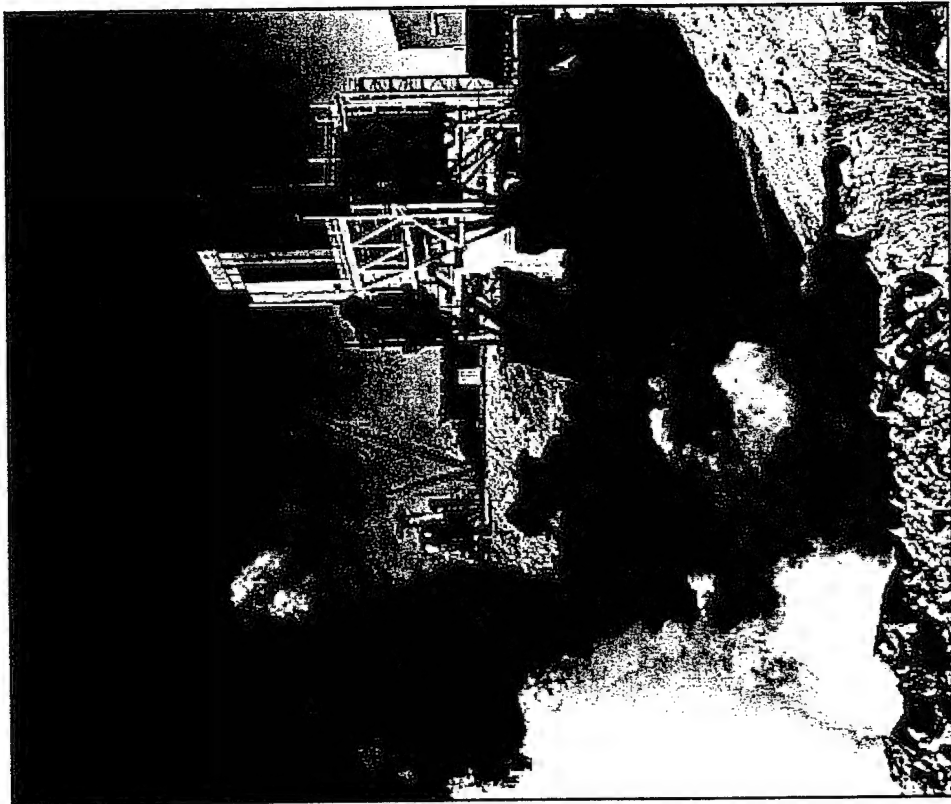


TESTING HISTORY

- Titan 34D, 1987
- Titan IV
- Saturn V
- SRM Booster
- SRMU Booster, 1992, 1993, 1999



Area 1-125, Test Stand 1-C



- Successfully Fired T34D SRM, 15 June 1987



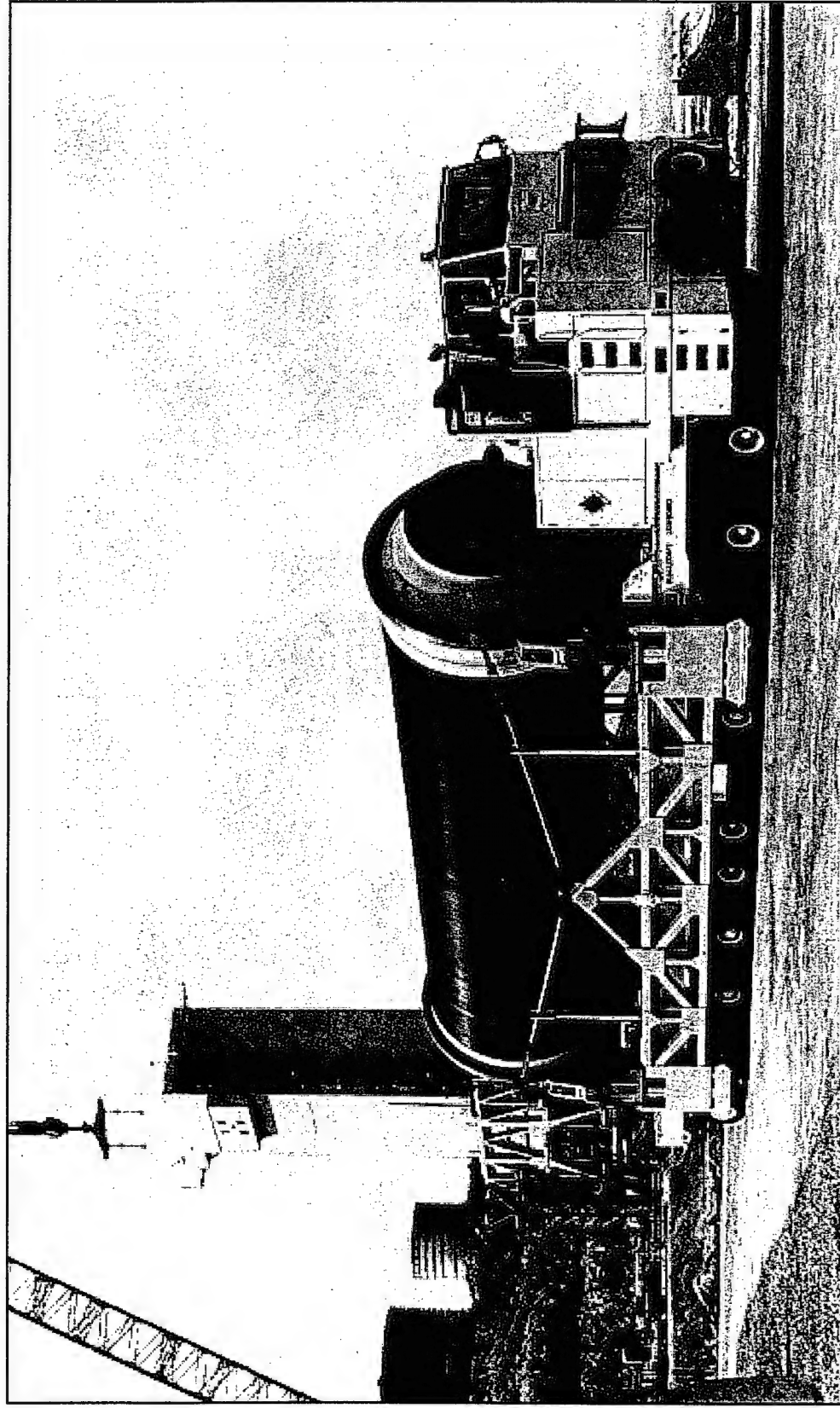
Area 1-125, Test Stand 1-C



Titan IV SRMU Booster Railhead Delivery to AFRL, 1993



Area 1-125, Test Stand 1-C



Titan IV SRMU Booster Test Stand Delivery, 1993



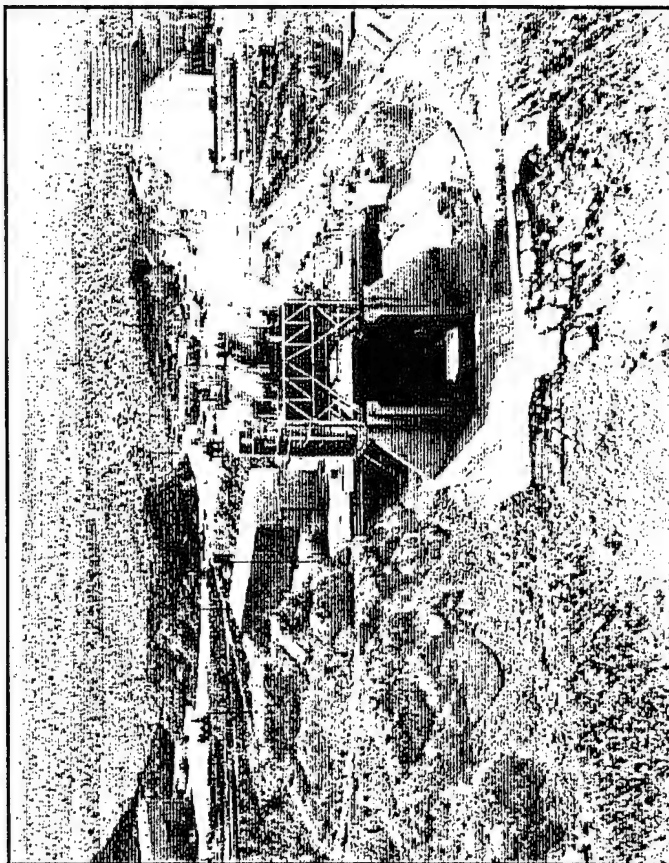
Large Systems Complex Area 1-125, Test Stand 1-D

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Mechanical Shop
 - With 25 Ton Traveling Overhead Crane
 - With Environmental Conditioning

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 6,000,000 lbf., Nozzle Down
 - (Current Configuration) Inactive, No Thrust Stand
- 760,000 lb of 1.3 Propellant



TESTING HISTORY

- Saturn V



National Hover Test Facility

Area 1-125, Test Stand 1-E

FACILITIES CAPABILITIES:

- 6,000 psi GN2 Cross Country Line
- 6 Inch Water Main
- 440 VAC and 28 VDC Stand Power
- Target Test Stand
- Vehicle Integration Facility, With a Clean Room
- Propellant Storage and Handling
- Range Support for Fueling / Handling KKV's at Remote Sights

TEST STAND CAPABILITIES:

- Ground Level Testing
- Maximum Thrust 6,000,000 lbf., Nozzle Down
 - (Current Configuration) Inactive, No Thrust Stand
- 690,000 lb of 1.1 Propellant
- Mechanical Shop Converted to Hover High Bay and Control Room
 - Kinetic Kill Vehicle (KKV) Free Flight Environment
 - Low Cost
 - Recoverable
 - Repeatable
 - Observable
 - Integrated Instrumentation Systems
 - Video Trajectory Tracking
 - Telemetry Uplink and Downlink
 - Precision Laser Velocity and Positioning Measuring System
 - Center of Gravity and Moment of Inertia Measurement



TESTING HISTORY

- 11 Different Vehicle Configurations
- Liquid and Solid Propellant Systems
- 26 Static Tests
- 16 Free Flight Tests



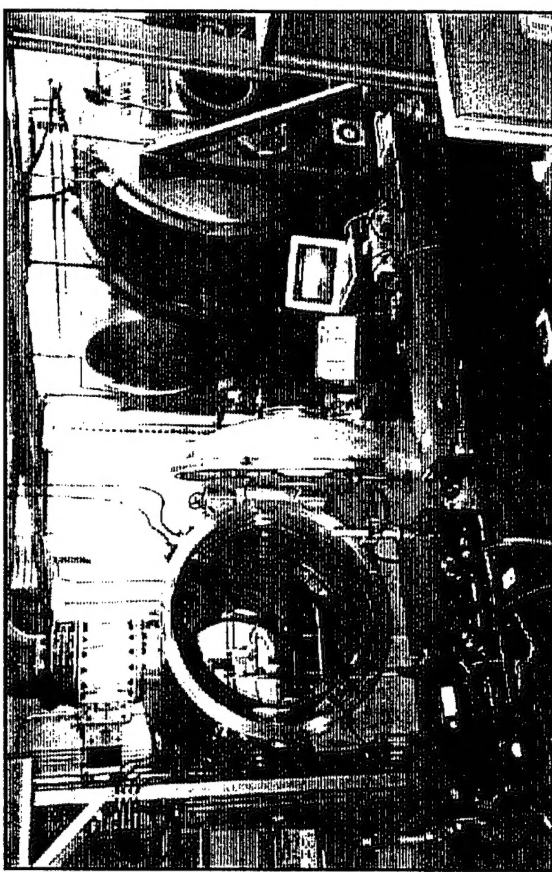
Electric Propulsion Laboratory

GENERAL AREA CAPABILITIES:

- Mechanical, Diffusion, Turbomolecular, and Cryo Pumped Vacuum Systems
- Data Acquisition and Control System

TEST CELL CAPABILITIES:

- Two 600 Cubic Foot Arcjet Chambers
 - 8 Foot Diameter x 12 Foot Long Chamber
 - 50 kWe
 - 10-2 TORR Vacuum
 - Pumps 250 mg/sec Propellant
- 200 Cubic Foot Pulsed Plasma Chamber
 - 5 Foot x 8 Foot Long Chamber
 - 20 MWe Pulsed
 - 10-5 TORR Vacuum
- 2000 Cubic Foot Chamber (Planned)
 - 10 Foot Diameter x 20 Foot Long Chamber
 - 30 kWe
 - 10-6 TORR Vacuum
 - High Power Hall Thrusters

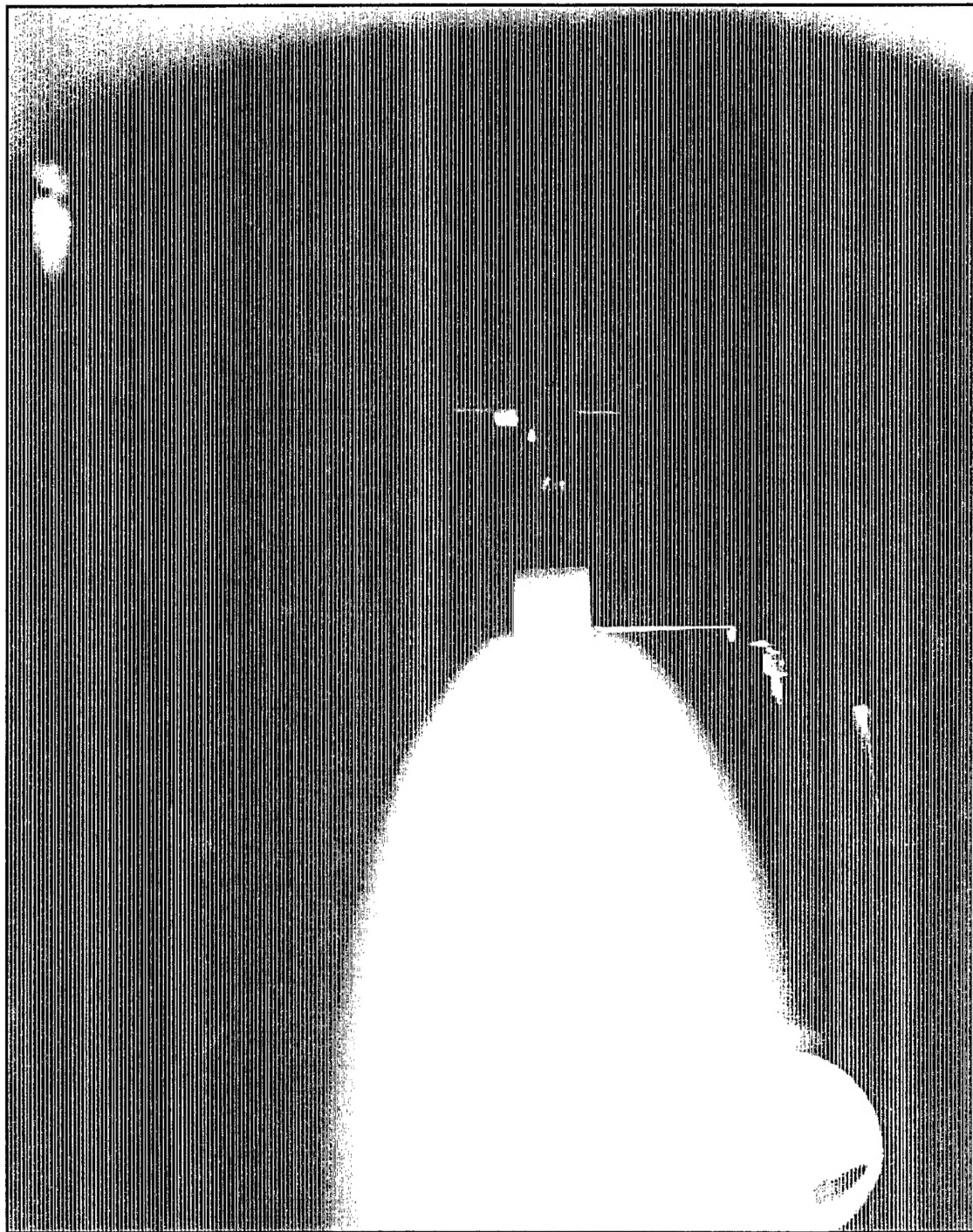


HISTORY:

- Ammonia 1995
- Hydrogen 1993-1996
- Carbon Based Propellant (Methane) 1995
- Electric Space Experiment (ESEX) 1995
- Collaborative efforts with; Loin Aerospace, NASA Lewis, and 6 Universities
- Teflon 1985-1996

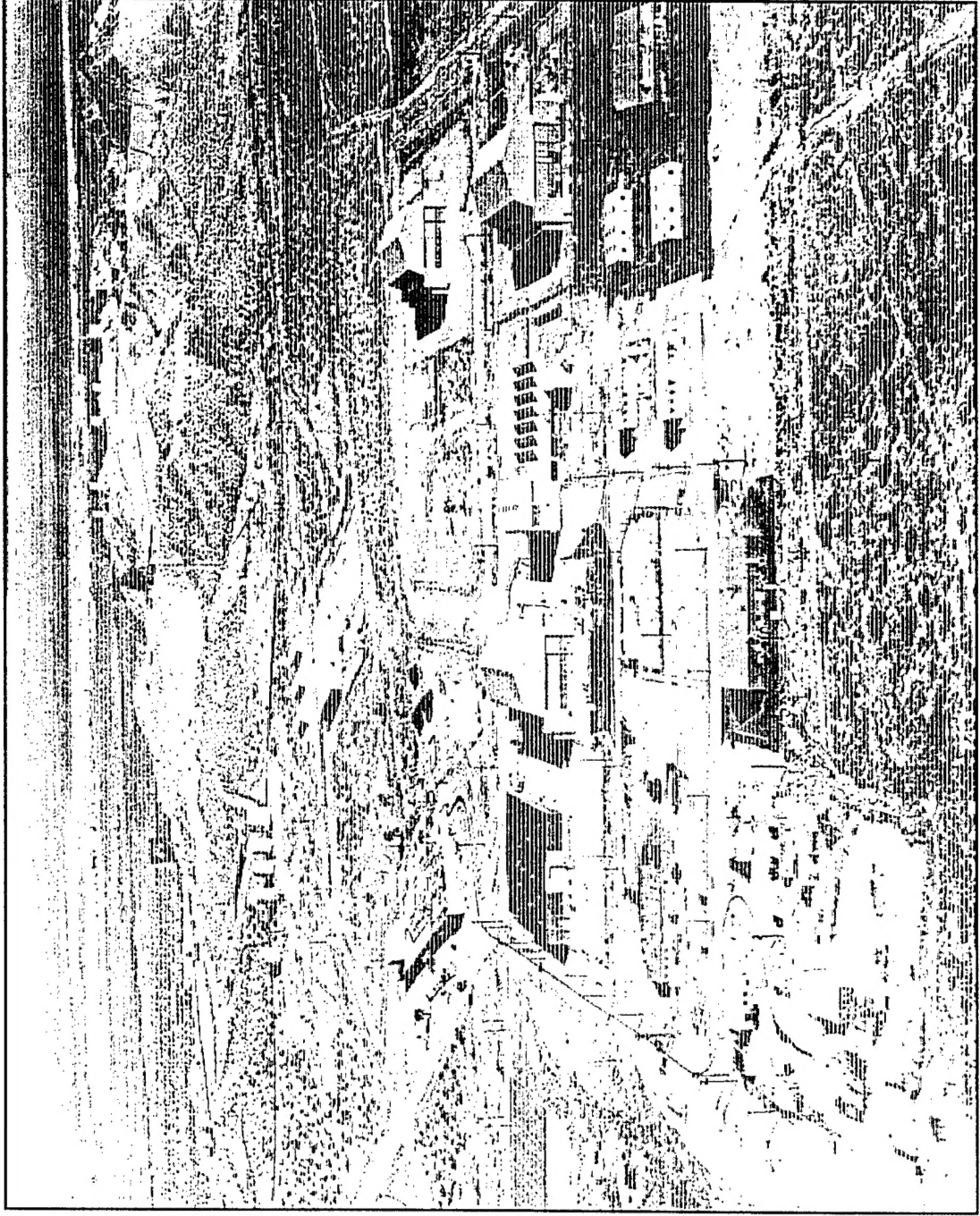


Electric Propulsion Laboratory





Air Force Research Laboratory Fabrication Area



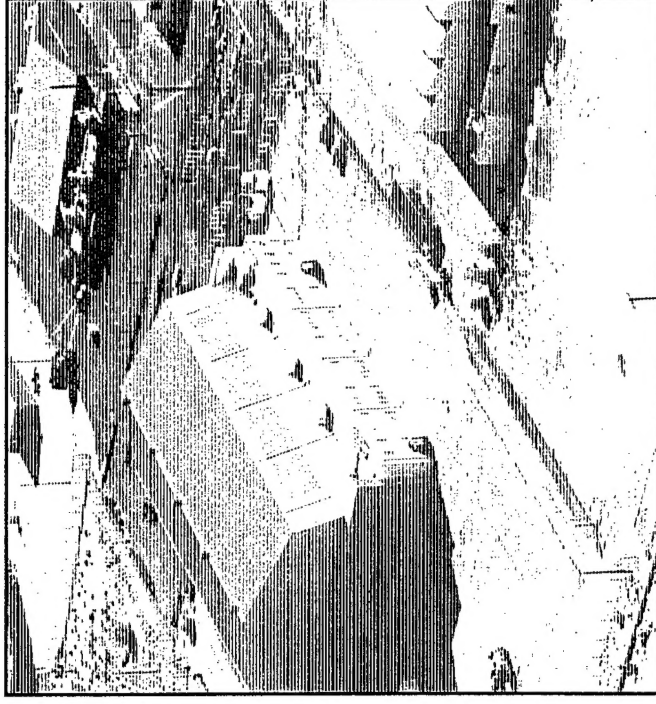


AFRL Fabrication Area Missile Assembly Building Building 8419

D2318B 041

BUILDING CAPABILITIES:

- Four 25 Ton Overhead Cranes
- 17,000 Sq Ft of Work Space Under Crane Span
- Building is 60 Ft to Peak
- 40 Ft of Vertical Work Space Under Crane
- 8,000 Sq Ft of Office Space Adjacent to Work Space
- Building Originally Built for Missile Assembly
 - Currently Used for Welding and Fabrication Work
- Full Service Machine, Weld, and Fab Shops Nearby
- Building Within Fenced Area and Within Air Force Research Laboratory Restricted Area



HISTORY: